



TRINIDAD AND TOBAGO.

ADMINISTRATION REPORT
OF THE
DIRECTOR OF AGRICULTURE.
FOR THE YEAR 1934.

TRINIDAD:

PRINTED BY THE GOVERNMENT PRINTER,
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1935.

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Council Paper No. 72 of 1935.

DEPARTMENT OF AGRICULTURE.

Administration Report of the Director of Agriculture
for the year 1934.

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REPORT OF THE DEPARTMENT OF AGRICULTURE FOR THE YEAR 1934.

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DEPARTMENT OF AGRICULTURE.

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I.—AGRICULTURAL EXPORTS.

The total value of the agricultural exports for the calendar year 1934 amounted to £1,511,051 as compared with £1,896,644 in the previous year.

2. Sugar and its by-products, with a value of £951,835, led by a wide margin, but showed a decrease of approximately £200,000 as compared with 1933. Cocoa fell to £349,694 which marks the lowest level in the past 50 years. Coconuts and by-products showed a decrease of £20,000. Grapefruit and oranges—mainly grapefruit—were responsible for an increase of £17,000 and Tonca Beans for over £11,000. In all there was a nett decrease of £385,000 for the year as compared with 1933.

3. Comparative figures are given below for the exports of the staple and minor crops from 1926-1928—years that are representative of the period before the world trade depression set in—and for 1933 and 1934.

Agricultural Exports.

Article.	1926-1928 average yearly value.	1933 Value.	1934 Value.
Sugar and By-products	£ 1,014,677	£ 1,160,054	£ 951,835
Cacao	1,531,148	555,907	349,694
Coconuts and Coconut Products	223,768	108,009	88,823
Coffee	12,833	7,416	10,595
Limes and Lime Products	6,056	27,210	28,594
Grapefruit and Oranges	2,028	5,618	22,777
Grapefruit and Orange Juices	..	1,759	1,711
Tonca Beans	1,824	3,004	14,822
Pulse, Beans and Peas	4,816	2,515	1,899
Livestock and Hides	8,441	1,490	5,967
Bitters	76,862	21,205	29,184
Miscellaneous	20,192	2,457	5,150
	2,902,645	1,896,644	1,511,051

SUGAR.

Sugar Production.

4. Weather conditions were not as favourable as in the previous year and production fell from 120,763 tons to 105,342. Production figures for the past nine years follow :—

	Tons.
1926	73,561
1927	51,982
1928	81,551
1929	89,926
1930	79,848
1931	98,573
1932	97,598
1933	120,763
1934	105,342

Exports and Values of Sugar and Sugar By-Products.

5. According to the Customs returns the exports and values of sugar, molasses and rum for the years 1926-1934 were as follows :—

			SUGAR.		MOLASSES.		RUM.		Prices Grey Crystals f.o.b. per ton.
			Exports.	Value.	Exports.	Value.	Exports.	Value.	
			Tons.	£	Gals.	£	Gals.	£	£ s. d.
1926..	..	..	65,680	1,003,230	1,427,274	14,330	71,213	10,933	14 15 0
1927..	..	..	41,805	762,366	1,188,840	14,471	35,699	8,155	16 10 0
1928..	..	..	74,112	1,201,477	1,622,018	16,913	55,088	12,157	14 10 0
1929..	..	..	81,503	1,049,863	1,373,420	18,227	73,841	13,639	11 10 0
1930..	..	..	69,138	776,167	899,051	11,238	72,063	14,313	10 5 0
1931..	..	..	86,054	902,990	1,599,414	15,924	86,260	15,719	9 0 0
1932..	..	..	85,956	845,974	2,701,921	14,697	139,540	27,521	9 14 2
1933..	..	..	108,516	1,115,567	3,026,077	31,634	63,907	12,853	9 10 0
1934..	..	..	93,513	916,232	2,310,381	24,115	50,977	11,488	8 13 10

Price of Sugar.

6. As shown in the above table a new low level record for the price of sugar was established, the average f.o.b. price per ton of grey crystals being £8 13s. 10d., for the six months January to June as compared with £9 10s. 0d. for the corresponding period of the previous year.

Cane Farming Industry.

7. Comparison of the year 1934 with 1933 shows that in 1934 cane farmers sold 370,153 tons to the Factories and received £203,583; in 1933 they sold 488,174 tons and received £297,822. The sugar manufacturers reduced their price from 12/- to 11/- per ton owing to the continued low value of sugar in the world's markets, but the price was much above what would have been paid had the official sliding scale been used as the basis of payment, and cane farmers received £93,309 more than they were entitled to under the sliding scale.

COCOA.

8. For the nine years 1926-1934 the cocoa exports for the colony were :—

			Exports.	Value.	Price per
			lb.	£	fanega (110 lb.)
					\$ c.
1926	..	..	50,067,881	1,270,335	12.99
1927	..	..	51,934,857	1,671,883	15.82
1928	..	..	58,008,156	1,651,179	13.21
1929	..	..	61,888,740	1,446,127	10.99
1930	..	..	53,825,120	1,136,056	9.34
1931	..	..	57,186,512	826,333	6.88
1932	..	..	41,822,127	579,170	6.94
1933	..	..	51,311,274	555,907	5.03
1934	..	..	26,803,149	349,694	6.44

9. In 1932 the crop was approximately 42,000,000 lb.; in 1933 it rose to 51,000,000 lb., and in the year under review it fell to 26,803,149 lb. This drastic reduction in yield can be attributed largely to unfavourable weather conditions for low yields were common in areas where thrips and witchbroom were hardly in evidence. The continuation of low prices from 1929 was, even with average yields, bound to result in much financial embarrassment to cocoa proprietors, and the abnormally low yield of the year under review has added greatly to their difficulties. In consequence many of the cocoa estates are being seriously neglected and assistance to the industry is urgently needed. Of the export crops sugar, cocoa, copra, grapefruit and bananas, cocoa alone does not have the advantage of some substantial form of protection.

Witchbroom Incidence.

10. The year 1934 was marked, as were previous years, by an extension of the disease to estates and districts not previously affected, but there was no evidence of increased intensity, due, doubtless, to the lower rainfall. But, it must be recorded that a very disquieting increase has occurred, since the period covered by this report, in the number of mature pods affected by witchbroom.

COCONUTS.*Exports and Values.*

11. There was a falling off in the quantities of copra and coconut oil exported and an increase in the number of nuts. In terms of nuts, the total exports amounted to 65,036,934 as compared with 68,013,345 in 1933, and the total value was £88,823 as compared with £108,009. Values fell sharply during the year, and the average price of copra was no more than 5s. 10d. for the year as against 9s. 5½d. in 1933.

			COCONUTS.		COPRA.		COCONUT OIL.		Price of Copra.
			Exports.	Value.	Exports.	Value.	Exports.	Value.	
			Nuts.	£	lb.	£	Gals.	£	100 lb.
1926	..	..	5,041,036	25,135	13,858,996	166,263	82,791	15,373	23s.
1927	..	..	6,463,765	32,298	12,498,983	146,895	58,061	11,102	22s.
1928	..	..	6,799,655	34,824	21,351,860	227,555	65,285	11,860	20s.
1929	..	..	13,608,118	66,320	23,979,882	209,732	34,707	5,403	17s.
1930	..	..	5,886,127	25,830	21,891,259	175,965	41,154	5,938	14s.
1931	..	..	4,487,875	12,549	19,484,808	101,148	20,702	1,816	8s. 9d.
1932	..	..	3,847,245	12,822	15,418,906	91,444	26,461	2,520	10s. 2½d.
1933	..	..	7,888,980	21,406	19,357,980	82,945	45,565	3,658	9s. 5½d.
1934	..	..	9,850,299	29,128	17,928,775	57,451	31,118	2,244	5s. 10d.

Coconut Oil Factories and Bonus.

12. Much satisfaction is justified at the results of the agreement between Government and the Oil Factories by which a bonus is distributed to all producers of copra when the price falls below 12s. 6d. per 100 lb. The Factories purchased 9,938,072 lb. of copra and distributed £29,149 which amounted to a bonus of approximately 2s. 1d. per 100 lb. of copra on the local price of 5s. 10d. A bonus of 2s. 1d. per 100 lb. with prevailing prices is of material assistance to the cultivator.

Coconut Wilt.

13. This disease continued to take toll of the coconut population of the Caroni plain and of other soils unfavourable for the growth of coconuts. Further reference is made to this subject later.

HURRICANE DAMAGED AREA.

14. Very satisfactory progress was made in the replanting of the coconut cultivations damaged by the hurricane of 1933, advantage being taken by the proprietors of the assistance provided for by the Hurricane Relief Ordinance.

LIMES AND LIME PRODUCTS.*Area.*

15. The area in limes is roughly calculated to be between 2,600 and 3,000 acres, but an accurate estimate is difficult owing to the number of lime trees scattered in small quantities throughout the colony.

Exports.

16. The exports of lime oil were the largest on record, although less green limes were exported compared with the previous year. Both facts are explained by dry weather :

- Wither-tip disease was less abundant owing to the dry weather.
- The dry weather made flowering and fruit setting too late for any considerable quantity of fruit to be available in time for the best season in the United States markets.

Lime Oil.

17. Exports and values for the years 1926-1934 were as follows :—

						Exports.	Value.
						Gals.	£.
1926	..	..	..	..	..	431	5,312
1927	..	..	..	..	..	104	1,454
1928	..	..	..	..	..	495	5,894
1929	..	..	..	..	..	797	9,516
1930	..	..	..	..	..	1,647	19,457
1931	..	..	..	..	..	2,413	32,071
1932	..	..	..	..	..	929	12,840
1933	..	..	..	..	..	1,889	22,575
1934	..	..	..	..	..	2,882	25,055

Lime Juice.

18. There was a slight decrease in the exports of concentrated juice and very little raw juice was shipped.

							CONCENTRATED JUICE.		RAW JUICE.	
							Exports.	Value.	Exports.	Value.
							Gals.	£	Gals.	£
1926	..	..	..	..	..	..	7,886	1,926	Nil.	Nil.
1927	..	..	..	..	..	..	4,488	1,154	Nil.	Nil.
1928	..	..	..	..	..	..	5,653	1,487	Nil.	Nil.
1929	..	..	..	..	..	..	55,455	11,562	Nil.	Nil.
1930	..	..	..	..	..	..	21,762	3,759	47,554	4,096
1931	..	..	..	..	..	..	4,012	458	22,931	2,007
1932	..	..	..	..	..	..	8,583	427	46,629	4,250
1933	..	..	..	..	..	..	11,709	622	17,375	1,203
1934	..	..	..	..	..	..	9,110	535	3,479	294

Green Limes.

19. Exports of green limes for three years are given below :—

[illegible]

GRAPEFRUIT.

Area.

20. A census taken of grapefruit plantations at the end of December, 1934, showed that there were 1,504 acres under budded grapefruit, principally of the Marsh variety.

Exports.

21. The grapefruit crop was very much larger than in the previous year and there was a marked improvement in quality. This was due to drier and more favourable weather conditions, and to young cultivations coming into bearing. Fruit on the trees at the end of the year gave promise that the 1934-1935 crop would be double that of 1933-1934.

22. Market reports testifying to the good quality of the Trinidad grapefruit continue to be received.

					<i>Exports.</i>	<i>Value.</i>
					<i>Boxes.</i>	<i>£</i>
1926	...	...	...	...	54	50
1927	...	...	...	...	1,649	1,427
1928	...	...	...	...	23	45
1929	...	...	...	...	807	606
1930	...	...	...	...	2,184	910
1931	...	...	...	...	4,377	1,874
1932	...	...	...	...	10,973	8,978
1933	...	...	...	...	3,433	2,586
1934	...	...	...	...	23,518	18,634

COFFEE.

23. There was an increase in the quantity and total value of coffee exported in 1934 compared with the previous year.

					<i>Exports.</i> <i>lb.</i>	<i>Value.</i> <i>£</i>
1926	..	..	..	..	497,688	20,371
1927	..	..	..	..	164,072	7,246
1928	..	..	..	..	265,410	10,883
1929	..	..	..	..	817,983	32,309
1930	..	..	..	..	491,988	12,525
1931	..	..	..	..	857,920	16,276
1932	..	..	..	..	908,492	20,822
1933	..	..	..	..	339,196	7,416
1934	..	..	..	..	525,115	10,595

TONCA BEANS.

24. The year 1933 was an off year for tonca beans ; 1934 was a good year.

					<i>Exports.</i> <i>lb.</i>	<i>Value.</i> <i>£</i>
1926	...	...	...	...	83	8
1927	..	...	...	..	10,015	1,669
1928	..	...	...	..	884	147
1929	...	..	...	..	15,266	2,544
1930	...	...	...	..	9,219	1,538
1931	..	...	...	..	22,950	3,583
1932	..	...	...	..	69,276	12,993
1933	..	..	..	..	9,979	3,004
1934	..	...	...	..	45,450	14,822

BANANAS.

25. Bananas must now be added to the list of exports, although the quantity shipped was small. An indirect advantage to the agriculturist of the purchase of bananas for export has been the substantial increase in the price paid for bunches bought for local consumption.

26. From returns received, it is roughly estimated that there are now some 300,000 stools of Gros Michel bananas of all ages in Trinidad and 13,000 in Tobago. Increased plantings are being planned for 1935 as planting material becomes available.

27. Reference is made in the second part of this report to certain important aspects of the development of this industry.

Exports of Gros Michel.

					<i>No. of Bunches.</i>	<i>Value.</i> <i>£</i>
1933	..	..	..	..	3,825	394
1934	..	..	..	..	46,287	4,340

II.—DEPARTMENTAL INSTITUTIONS AND OTHER ACTIVITIES.

28. This section is devoted in the main to a brief review of the work of the departmental institutions and of the technical officers, the plant protection inspectors, and the district staff. Detailed reports by the officers in charge of the sub-branches of the Department form Part III of the report.

COCOA.**River Estate.**

29. Mr. R. O'Connor, Manager, reports in some detail on the varied activities at River Estate. Originally taken over as a cocoa estate, the plantation has since been developed on broad lines and the wisdom of establishing subsidiary crops is now apparent. The acreages under cultivation at the end of 1934 were :—

				<i>Acres.</i>
Cacao	..	..	..	452 (12 acres not yet bearing).
Limes	..	..	..	60 (40 acres not bearing).
Grapefruit and oranges	..	..	..	30
Mangoes	..	..	..	6 (now coming into bearing).
Tonca Beans and Coffee	..	..	..	40 (interplanted—10 acres not yet bearing).
Curtilages, pastures, &c.	..	..	..	50
Timber	..	..	..	600
				1,238

Experimental Work.

30. During the past two or three years, a more emphatic bias has been given to the experimental aspect of the work. This has been possible owing largely to the desire of the Cacao Research Staff to take advantage of the opportunity offered of conducting certain of their experiments on cocoa trees the individual yields of which are known for a number of years past. At River Estate the yields of some 15,000 trees have been carefully recorded since 1910.

31. At the request of the Principal of the Imperial College of Tropical Agriculture, thirty-five acres are being set aside for the use of the Cacao Research Staff for the purpose of comparing the vegetative progenies of 100 trees selected by Mr. F. J. Pound for their high-yielding properties and type of beans. The comparison will include different methods of propagation. A three-year planting programme has been worked out by Professor Cheesman, and Government has sanctioned the necessary expenditure at River Estate.

32. A recent departmental experiment is the planting up of 12 acres in Latin squares with seedlings from six selected heavy bearers. The young plants, put out in 1933, are making excellent growth, and this experiment will prove a most interesting seedling progeny test.

33. *Distance Planting.*—Crop yields have been recorded for the past seventeen years. For sixteen years, up to 1933, the plots planted 12 and 14 feet apart are practically identical, viz., 443 and 440 pounds of commercial cocoa per acre, per annum, respectively, and the 12 feet by 12 feet plot had apparently reached its maximum production. These yields are appreciably higher than those recorded for the plots planted at 16 and 18 feet. During later years the wider plantings have made considerable progress.

34. *Budded Plants vs. Seedlings.*—This experiment was started in 1914 and for the past three years the Budded plants, in the section with Immortal shade, gave better results than the Seedlings. The average yield from the commencement of bearing, seventeen years (1918-34), for the plots budded at stake has for the first time slightly exceeded that of the Seedling plot. In the section without Immortal shade the Seedlings still give a better yield than the Budded plants.

35. *Colour of Pods.*—There has been no change in the results of this experiment for 1934. The plots grown from trees bearing red pods have given appreciably higher yields than those bearing yellow pods.

36. *Experiment with Superphosphate of Lime.*—The plot planted 12 feet apart in the Distance Planting Experiment was laid out as a 3 x 3 Latin square and Superphosphate of Lime at the rate of $1\frac{1}{2}$ and 3 pounds per tree, respectively, was applied annually from 1932. The first year's crop subsequent to manuring showed that although a large increase in yield was obtained the results were not "significant", but, with a further increase of crop for the second year, the application of phosphates on this area is significant.

37. *Experiment with Nitrogen, Phosphate and Potash.*—This experiment is being made in Field 8, River Estate, and consists of a 4 x 4 Latin square to test the effects of nitrogen and potash upon which is superimposed a half-plot treatment of phosphate. The fertilisers are being applied annually from 1933. The results for the first experimental year are being published in detail in the Fourth Annual Report on Cacao Research. The application of potash gave significant results on this area.

Witchbroom Disease of Cocoa.

Inspection Service.

38. A staff of 32 Assistant Inspectors has been kept busy visiting estates, and in cases of flagrant neglect plant protection orders have been issued. In the year the number of orders was 97.

39. It has to be frankly admitted that, owing to the low level of prices, it has been quite impracticable to insist on even the minimum degree of effort believed to be necessary for keeping this disease within reasonable control.

Spread of Disease.

40. As a result of the inadequate attention to control measures—which consist of cutting off diseased brooms before they form spores—the spread of the disease has been unduly rapid during the past three years in particular. Witchbroom disease was first discovered in 1928 and up to the end of 1934 it had been found on 4,927 of the 17,000 cocoa properties in Trinidad; of this number 482 estates were reported as being infected for the first time during 1934.

41. In the past, infection of mature pods was serious only in exceptional cases, but reference must be made here to the fact that, since the close of the year under review, there has been a distinctly alarming increase in the number of mature pods affected by the disease, particularly on estates in the Guaico-Tamana area. In the important cocoa district of Montserrat and on the Northern Range the infection of mature pods is still only slight. Records at the Marper estate are given below.

Marper Witchbroom Estate.

42. Study of the witchbroom disease of cocoa under estate conditions has been continued on the Government property Marper where the disease was first discovered in the colony, and which lies in the heart of an area now badly affected.

43. There are 92 acres under cocoa on the estate and the following figures show the incidence of brooms, mushrooms, and infected mature pods for the past four years :—

	1931.	1932.	1933.	1934.
Brooms.. ..	250,538	195,595	223,328	194,459
Mushrooms	2,637	665	68	166
Crops—bags	196	211	202	204
Mature pods affected with witch- broom—per cent.	6.5	0.9	1.2	1.3

The percentage of mature pods affected with witchbroom for 1931 to 1933 is computed from records on three separate acre-blocks representing average conditions. The figure for 1934 is for the whole estate.

44. The above figures, and those for 1935 to date, establish that it has been possible up to the present to prevent the infection of mature pods getting out of control.

45. Admittedly the cost on Marper Estate of cutting out brooms, &c., has been higher than could be afforded by the average private estate with prices at the level that has obtained on recent years. On the other hand, high yielding estates could meet the cost of such work under normal price conditions. At Marper the cost of cutting out and destroying diseased material for 1934 was \$5.00 per acre of which \$0.90 was for extra supervision and keeping records of individual trees on the experimental section, but the latter is not part of ordinary estate practice. Marper costs are \$1.00 less per acre than for the previous year, and with the object of further reducing the cost of control, witchbroom will in 1935 be cut out every alternate month instead of monthly as in the past.

Strains of Cocoa Resistant to the Disease.

46. Mr. Stell's observations during his visit to Ecuador in 1933 definitely established that strains comparatively resistant to witchbroom have been developed in that country. It has not yet been possible to secure the planting material of these strains that was promised to Mr. Stell.

47. A systematic search for witchbroom resistant strains in the island has been started. Some 150,000 trees have been examined in the worst fields of the worst affected district. Only 400 were found to be free of the disease on first inspection and by the end of 1934 witchbroom was found to have affected 276 of these, leaving 124 of which 52 were mature trees. Further whittling down of the number is to be expected and there are no grounds at the moment for justifying a confident belief that any of these trees will eventually prove resistant.

48. Through the kindness of His Excellency the Governor of Surinam and Dr. Stahel, Director of Agriculture, material from a witchbroom resistant cocoa tree in that colony is under trial.

Thrips Control.

49. As a result of excessive shade reduction in 1930 and 1931, as part of the Witchbroom experiments, the trees suffered considerably from exposure; thrips were prevalent from November 1931 to January 1933 and caused a serious loss of crop on a block of approximately 48 acres. Spraying with Bordeaux Mixture was carried out on this block in 1933 and repeated in 1934, as a control for thrips. The results of the treatment have been very striking: thrips have been kept off; the trees have recovered; and normal crops have been restored on this block. The spraying done in 1933 could hardly have affected the crop of that year, and the sprayed section of the estate yielded 294 lb. of cocoa per acre against 434 lb. for the other half of the estate. In 1934 one of the worst cocoa crops was

experienced in Trinidad, yet the sprayed block maintained its yield of the previous year whereas the unsprayed block showed a drop of 36 per cent. That still better results will be obtained in 1935 for the sprayed plots are clearly indicated from the yields obtained to end of April.

50. With regard to the cocoa cultivations in a number of areas, thrips continues to be a major pest, and it is hoped that the negotiations in progress regarding the possibility of introducing the thrips parasite known to occur on the west coast of Africa will prove successful.

SUGAR.

Sugar Cane Investigation Committee.

51. Joint contributions on a half and half basis by Government and the Sugar Manufacturers placed a sum of £4,252 at the disposal of the Sugar Cane Investigation Committee, and a grant of £2,000 was made from the Colonial Development Fund to be spread over three years. Results of the various investigations undertaken by the Chemical Division under the charge of Mr. P. E. Turner, and of the Entomological Division under the charge of Mr. A. Pickles, have been regularly reported in the Proceedings of the Committee. Study of cane moth borers was added to the work of the Entomological Division.

Appointment of Sugar Agronomist.

52. Mr. P. E. Turner was transferred from the staff of the Sugar Cane Investigation Committee to the Department of Agriculture as Sugar Agronomist in October 1934, and his work continues to be on the same lines as when he was an officer of the Sugar Cane Investigation Committee.

COCONUT WILT.

53. Mr. F. M. Bain, District Agricultural Officer, has continued his studies of coconut wilt and his report on this subject will be found in Part III. In November, he addressed the Agricultural Society and put before the members the results of his investigations to date.

54. A definite correlation has been established between the occurrence of wilt and certain broad geological soil types and Mr. Bain makes the following classification :—

Soils on which " Wilt " Occurs.

- (1) Swamp alluvium.
- (2) River alluvium.
- (3) Princes Town marl.
- (4) Red weathering clay.
- (5) Caroni sand.

Soils on which " Wilt " does not Occur.

- (1) Sandy coastal belt.
- (2) Volcanic clay of Cedros area.
- (3) Brasso silt.
- (4) Soil derived from " Porcellanite ".
- (5) Detrital soils.
- (6) Pointe-a-Pierre grit.

55. Root studies have demonstrated that in the majority of cases the disease is associated with root destruction due to unfavourable subsoil and moisture conditions. In these circumstances control measures present a very difficult problem, and avoidance of unsuitable types of soil in the future is the best that can be recommended.

56. New field experiments have been laid down with the object of further elucidation of various aspects of the trouble.

BANANAS.

57. The experimental shipments made possible by the courtesy of Messrs. Elders & Fyffes came to an end in April 1934. After deducting the cost of the fruit and the handling charges, there was a total profit of over £700 on the seven trial shipments. The venture proved that Trinidad Gros Michel bananas were acceptable to the trade and could be marketed at a profit.

58. Early in the year a Banana Board was established and in May a contract was entered into between the Board and the Canadian Banana Company, under which the Company agreed to purchase at fixed prices all marketable Gros Michel bananas offered for export for a period of five years. In return, the Board, with the sanction of the Legislature, gave the Company a monopoly for the purchase of Gros Michel bananas offered for export during this period.

59. An accurate assessment by agriculturists in the colony of the possibilities of bananas as a useful subsidiary export industry is important. The Department wishes to see the fullest possible advantage taken of the unique opportunity that now offers of growing a crop that involves little capital expenditure (where use is made of established cocoa lands), that brings in quick returns, and for which a market is guaranteed at a fixed price for five years: but, it is necessary that there should be a due appreciation of the risks involved and of the conditions that will make for success.

60. Primary among the risks is the danger of Panama disease which is already scattered throughout the colony. Experience elsewhere has demonstrated the advantages of an alkaline or neutral soil, as compared with an acid soil, for retarding the spread of Panama disease. The reaction of the soil must, therefore, be considered by those who are planting bananas. That this fact is not yet fully realized can be instanced by reference to one estate where a block of bananas has been planted on an acid clay although a calcareous soil could have been selected instead.

61. Also, attention cannot too often be drawn to the extreme folly of introducing on to an estate planting material of unknown origin. *Caveat emptor*—let the buyer be aware—applies forcibly to the purchase of banana plants and the issue is not confined to the immediate direct loss; the permanent contamination of an estate with Panama disease may be involved.

62. There is ample evidence already that Panama disease will be the limiting factor in the development in this colony of a banana industry, and the warnings repeatedly issued have unfortunately proved to be justified. Turning to the brighter side of the picture, it is possible to report that there are a number of plantings, mixed with cocoa, especially in the Montserrat, Tamana, and Toco areas, that give excellent promise of success.

63. Development of a banana industry on a scale of some magnitude will not be simple under local conditions; but cultivators, who acquaint themselves, by consultation with the officers of the Department, with the facts that are known regarding the nature of Panama disease and the cultural requirements of the banana crop, will be able to avoid many pitfalls.

ST. AUGUSTINE NURSERIES AND EXPERIMENTAL STATION.

The Nurseries.

64. Over 86,000 economic plants were distributed from the nurseries as compared with somewhat under 93,000 in the previous year. The demand for grapefruit plants was less than formerly and only 10,953 were sold as against 23,049 in 1933; but the number of citrus buds sold amounted to over 40,000 and was greatly in excess of the previous year. The reduced demand for grapefruit plants is attributable to the price having been raised from 12 to 25 cents, and possibly to the lower returns from shipments in the 1933-34 season.

65. There was a fair demand for the T. 1 lime—the hybrid developed by Mr. R. O. Williams. Samples shipped to the New York market as green limes were favourably reported upon.

66. Revenue for the year from the nurseries amounted to £1,715 19s. od.—an excess of £341 over 1934.

67. A detailed account of the work at the Nurseries will be found in the report of Mr. F. C. Buthn, Manager.

Experimental Station.

68. The citrus experimental block of 40 acres, which was planted to grapefruit and oranges in 1932, is already beginning to produce some interesting results.

69. In the experiment designed to test various cultural treatments without manures, very small growth differences have been recorded for the various treatments, the trees in the clean-weeded plots being slightly more vigorous than in any of the other plots.

70. The trees in the block with manures and no manures have shown the least growth response where no manures were applied, and little difference when nitrogen was applied alone. A marked result from the use of potash was recorded, which was still better when nitrogen was applied as well. Superphosphate alone

had little or no effect on tree growth, although it gave somewhat better results when used with potash. The treatments which included pen manure generally gave the best growth response.

71. In the demonstration block, where tilled and manured plots are being compared with untilled and unmanured, the growth records show that the trees have grown almost twice as fast in the treated portion.

72. Cane breeding and cultivation experiments with canes have been practically abandoned. Instead, selected varieties that are passed through the Plant Quarantine Station will be multiplied at the Station for distribution to estates; delay in the opening of the Station has allowed of but little progress along these lines as yet, and the only new seedlings propagated in 1934 for distribution were Mayaguez 28 and M. 10.

73. A report by the Manager, Mr. E. J. Gregory, on the work of the Station during 1934 will be found in the divisional reports.

GOVERNMENT STOCK FARM.

74. Owing to the severe drought at the Farm, the pasturage and the fodder crops proved quite inadequate and much ingenuity had to be exercised by the Officer-in-Charge to keep up a regular supply of roughage for the stock.

75. In keeping with the fixed policy of the Farm, breeding experiments with Zebus and Holsteins were continued with a view to establishing a type of dairy animal well suited for tropical conditions. The small herds of $\frac{1}{2}$ bred, $\frac{3}{4}$ bred, and $\frac{7}{8}$ bred crosses now contain 66, 36, and 25 animals, respectively.

76. The first step towards introducing the Sussex breed into Tobago was taken in the year when two bulls were sent to that island for stud purposes.

77. It is with much regret that the death of the thoroughbred stallion "Daddy" is recorded. "Daddy" was a gift from Lord Derby to the Government in 1928 and his progeny have had an excellent record. In 1933 his toals ran in the Trinidad Derby for the first time and St. Patrick won the Cup; Ironmonger, a full brother, won the Breeders' Stake; while two other foals won the Anchor Cup and the Port-of-Spain Handicap.

78. Public institutions were supplied with 37,476 gallons of milk during the year.

79. The usual annual sale of stock was held in December and the sum of £568 6s. od. was realized, made up as follows:—

						£	s.	d.
Cattle	..	..	..	..	..	406	13	4
Horsekind	..	..	..	..	..	60	8	4
Goats	..	..	..	..	..	11	5	0
Pigs	..	..	..	..	..	56	9	2
Poultry	..	..	..	..	..	33	10	2
						568	6	0

80. For the year the operating expenses amounted to £5,956 9s. 9d. and the revenue to £6,065 1s. od.

81. Details of the working of the Stock Farm are given by the Officer-in-Charge in Part III of this report.

Paralytic Rabies.

82. During the year 312 cases of deaths from this bat-borne disease were reported as compared with 308 cases in 1933. For the most part the disease was confined to an area south of the Northern Range and bounded on the west by St. Joseph, and on the east by Sangre Grande, and extending on the south into the Central Plain. The Government Veterinary Surgeon and his staff were responsible for the inoculation of 12,703 animals, including a number that were inoculated more than once.

83. Experimental evidence was obtained in 1934 by the Government Veterinary Surgeon to the effect that the saliva of animals suffering from paralytic rabies is infectious, but it would appear that transmission of the disease is normally due to the biting of animals by bats. Blood sucking bats feed on successive nights on the same spot on animals, and advantage has been taken of this fact to apply poison to these spots with promising results. The experiment was first tried by Dr. Lumsden on a heifer and five dead bats were found the next morning in the stall.

84. Concurrently with the work of the Government Veterinary Surgeon and the Government Pathologist, investigations of the life history and habits of the bats of the colony have been undertaken by Professor F. W. Urich who was appointed by Government in February to take up these studies. Information has been acquired regarding the roosting and digesting places of *Desmodus rufus* and other bats, and a successful technique has been developed for keeping *Desmodus* bats alive in captivity over considerable periods of time for experimental purposes.

DISTRICT AGRICULTURAL WORK.

Bananas.

85. As the export of bananas on a commercial scale had not been undertaken since 1914, the contract with the Canadian Banana Company, which came into force in May, called for a considerable amount of advisory work in regard to methods of planting and pruning, collecting the fruit, grading, handling, and shipping.

86. Government sanctioned the appointment of Mr. J. E. J. Beausoleil as Banana Officer, and his services have been utilised for giving field instructions and for collecting the fruit at the wharf and supervising its export.

87. Also, banana work is now an important feature of the duties of the Agricultural Advisers and of the Inspectors under the Plant Protection Ordinance. The latter officers are responsible, under the supervision of Mr. J. R. Foster, Chief Inspector, for the purchase of bananas in outlying districts and for the free destruction on small holdings of Panama disease infected stools.

Land Settlements.

88. The small land settlement schemes recommended by a Committee appointed by Government in 1932 have proved successful. An interesting competition was organized by the Nariva-Mayaro Agricultural Society at the Brothers Road Settlement. The Department of Agriculture made a small contribution towards the prize money and the Agricultural Adviser assisted the Society with the preliminary judging. The Assistant Director of Agriculture and the Agricultural Officer for the district carried out the final judging.

Competition in the Hurricane Damaged Area.

89. A Prize Holding Competition of some size was organized by the Agricultural Society in the hurricane struck area, and the Department of Agriculture was represented by the Assistant Director of Agriculture on the Committee entrusted with the management of the details. The preliminary inspections were made by the Agricultural Advisers of the districts in company with a planter appointed by the Society.

Government Fermentaries.

90. The Government Cocoa Fermentary at Biche worked smoothly and had the direct effect of improving the quality of small proprietors' cocoa produced in the area, while it had the indirect effect of raising prices offered by the local shop keepers. At Penal the competition of local buyers put the price to such a high level that less cocoa was received than was anticipated.

Food Crops.

91. The year under review was not favourable for the production of food crops owing to the drought, and the rice crop in particular was affected. Agricultural Advisers continue to endeavour to stimulate increased interest in this subject, but progress is not as satisfactory as it should be and agriculturists continue to spend far too large a proportion of their income on imported foodstuffs.

92. In previous reports I have summarized the *pros* and *cons* and have shown that the issue is not a simple one, but in spite of the difficulties associated with soils, praedial larceny, and local customs, it is regrettable, and economically unsound, that both large and small holdings are not more self-contained in as far as foodstuffs are concerned.

93. Importations of selected commodities for the year 1928—before the world depression set in—and for 1933 and 1934 are given below:—

	1928.	1933.	1934.
Flour	£ 440,237	£ 282,640	£ 288,305
Rice	215,197	147,855	164,262
Condensed Milk	106,043	83,317	94,709
Meat	74,778	72,606	72,372
Vegetables (Onions, Irish potatoes, &c.)	68,030	55,256	56,668
Beans and pulses	40,899	34,825	27,591

Special Duties.

94. Special duties undertaken by the Advisers included inspections of properties mortgaged to the Agricultural Bank, the preliminary judging of school gardens, and the estimation for the Public Works Department of what compensation should be paid for cultivations taken over for the construction of roads.

AGRICULTURAL CO-OPERATIVE SOCIETIES.*Agricultural Credit Societies.*

95. *Tobago*.—The thirteen Agricultural Credit Societies in Tobago under the supervision of Mr. F. D. Davies, Agricultural Adviser, had a membership of 530 at the close of the year. The Societies repaid to Government the sum of \$2,529.70 as capital and interest, but at the end of 1934 the sum of \$9,025.93 was still outstanding, of which \$6,873.43 was overdue. No new loans were made to the societies which are, in fact, doing little more than mark time owing to the depressed value of cocoa.

96. *Trinidad*.—Of the thirty-six credit societies in Trinidad, twenty-two are under the management of the Ste. Madeleine Sugar Company.

97. The fourteen societies under the control of the Department have a membership of 382 and are supervised by Mr. C. K. Hutchinson, Agricultural Adviser. Loans granted during the year amounted to \$4,826; the sum of \$4,707 was repaid as capital and interest, and at the end of 1934 the indebtedness of the societies was \$4,393.90 excluding new loans during the latter half of the year. The position of these societies was on the whole satisfactory which may be attributed to two facts: loans are confined to yearly crop advances repayable in one year, and the larger proportion of the loans were made to cane farmers.

Tobago Producers' Association.

98. A loan of £4,225 was granted to this Association by Government for the construction of a warehouse, the erection of an ice factory and a cocoa fermentary. The ice plant and cool storage were opened towards the end of 1934, and a start has been made in the marketing of coconuts, ground provisions, and fish. The Association is managed by an elected Board of 7 members, and at the end of 1934 had a membership of 111 of which 32 are large planters and 79 are small proprietors.

Tobago Lime Growers' Co-operative Association.

99. The Association handled 4,221 barrels of limes as compared with 2,821 barrels during the previous year and 1,550 in 1931 when the factory was opened. Unfortunately the prices obtained for lime oil were very low when compared with previous years, and, in consequence, members receive \$0.90 per barrel as against \$2.00 during the preceding season. The membership is 430, and of the 4,221 barrels handled, 56 per cent. were produced by the larger estates and 44 per cent. by the peasantry.

Co-operative Cocoa Fermentaries.

100. Due to unfavourable weather conditions for the cocoa crop, the Pembroke and Roxborough Fermentaries marketed 383 and 295 fanegas respectively as against 555 and 426 fanegas during the preceding season. Two new fermentaries have been established one at Parlaturier and the other at Delaford but the buildings were not completed in time for handling the 1933-34 crop. The membership of the four fermentaries is 124. The first co-operative fermentary started in 1929 with 11 members and handled 81 bags of cocoa. It is estimated that 1,000 bags will pass through the fermentaries in 1935. The Agricultural Adviser Mr. F. D. Davies has been responsible for developing this work.

Co-operative Citrus Growers' Association Ltd. of Trinidad and Tobago.

101. This Association completed its third year of operations on the 30th June 1934. It exported 17,065 boxes of grapefruit and 889 boxes of oranges as compared with 6,525 and 907 respectively for the previous year. Prices were fair. Grapefruit juice which found a good market in 1932-33 was unsaleable during the season under review and the Association sustained a loss on its preparation. A small canning plant was installed for the purpose of testing the suitability of Trinidad fruit for canning.

102. With the assistance of a free grant of £725 and a loan of £2,175 free of interest for five years from the Colonial Development Fund, the Packing House was enlarged to about double its original size. Some changes and additions have been made in the equipment, including a colouring plant and a machine for stamping the brand and country of origin on the fruit.

103. Excellent reports continue to be received by the Association from markets abroad as to the quality of Trinidad grapefruit.

COMMITTEE WORK.

104. The Director of Agriculture and the Assistant Director served on a number of committees in the capacity of chairman or member. The permanent committees were: The Agricultural Bank, the Cocoa Relief Committee, the Hurricane Relief Committee, the Sugar Cane Investigation Committee, the Citrus Growers' Co-operative Association, the Plant Quarantine Committee, the Field Experiments Committee, the Ground Provisions Depot Committee, and the Committee of Management of the Agricultural Society. Special Committees were: The Commission of Enquiry into the Labour Disturbances, and the Irrigation and Drainage Committee.

IMPERIAL COLLEGE OF TROPICAL AGRICULTURE.

105. In the course of this report I have had occasion to refer to certain investigations undertaken by the Imperial College of Tropical Agriculture on behalf of the planting community. These are but a few instances of the material assistance that the Imperial College gives to the agriculturists of the colony, and it gives me much pleasure to acknowledge the indebtedness of the Department to the Principal and his staff for their continued help and co-operation.

III.—REVENUE AND EXPENDITURE.

106. Annexure "A" contains a detailed statement of the accounts of the Department for the year, 1934. The total expenditure amounted to £47,826 and was slightly less than in the previous year; the total revenue was £16,738, and was £148 more than in 1933. The Stock Farm brought in £6,122, River Estate £3,317, the St. Augustine Nurseries and Experimental Station £1,862, and Veterinary fees £1,816.

107. The work under the Plant Protection Ordinance was responsible for the large sum of £5,371. Upkeep of the Royal Botanic Gardens, the Queen's Park Savannah and other Government grounds cost £3,746; and £2,126 was a contribution to the work of the Sugar Cane Investigation Committee.

IV.—STAFF.

108. The following appointments were made during the year: Mr. R. O. Williams, Economic Botanist was promoted to the post of Assistant Director of Agriculture on 8th March; Mr. P. E. Turner was appointed Sugar Agronomist on 1st October; and Mr. J. E. J. Beausoleil took up the duties of Banana Officer on 1st July.

109. Mr. J. de Verteuil, Agronomist, retired on 16th December, 1934, after having served Government faithfully for 35 years.

110. Mr. de Verteuil possessed an unusually sound practical knowledge of the cultural requirements of the crops of the colony—of cocoa in particular—and by his retirement the Department loses with regret the services of an officer whose judgment and advice was much valued by the planting community.

111. In concluding my report on the Department for the year, I desire to acknowledge the keen interest taken by the members of the Staff in their work and the efficient manner in which they have carried out the duties for which they were responsible.

E. J. WORTLEY,
Director of Agriculture.

15th May, 1935.

PART II.

DIVISIONAL REPORTS.

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REPORT OF THE ASSISTANT DIRECTOR OF AGRICULTURE.

General.

Staff.

I arrived in Trinidad from leave of absence on 19th March and assumed duties as Assistant Director of Agriculture, having been appointed to the post as from 8th March. I was also appointed Chairman of the Ground Provisions Depot as from 17th April.

2. Mr. F. C. Buttn had charge of the Citrus Experiment Station from January to March in addition to the duties of his substantive post and Mr. E. J. Gregory took up the duties of Manager after a six weeks visit to Barbados where he was sent to study the work of the Central Cane Breeding Station.

Citrus.

3. In addition to the administrative duties of my post, much time was devoted to all aspects of the Citrus industry. The work covered all stages of the crop, nurseries, field experiments, commercial groves, and marketing.

Handling and Marketing.

4. A considerable amount of detailed advisory work was undertaken in connection with my position as Government representative on the Board of Directors of the Co-operative Citrus Growers Association, and attention was also given to certain aspects of the subject when on leave in England. These included detailed examination of such questions as extension to the packing house and equipment, cold storage accommodation, ocean transport, canning and juice extraction and marketing. A good deal of progress has been made; the packing house is now enlarged to double its previous size with a capacity for handling 1,000 boxes of Citrus each day. Representations have reduced ocean transport from \$1.28 to 96 and 85 cents with opportunities for more frequent shipment. An experimental canning plant was installed and the equipment for juice extraction improved.

5. Additional regulations were made on the 23rd February, 1934, under the Export of Fruit Ordinance, No. 23 of 1931, specifying two further grades of fruit, viz.: (a) discoloured and (b) Culls and orchard runs.

6. The Department arranged a meeting of planters interested in limes for the purpose of meeting Mr. Swartz, who discussed lime marketing and advertising in New York.

Field Experiments.

7. The Manager of the St. Augustine Experiment Station has given certain details in connection with the experimental programme of manurial, cultural, and stock trials which were commenced in 1932 and cover 45 acres of land.

8. These experiments are already beginning to yield interesting data as regards tree growth, and the results to December, 1934, are being published in a separate paper. The value of fertilisers for manurial growth is very obvious to the eye and the recorded measurements bring out these differences very markedly.

Lime Breeding.

9. Studies of T1 principally from a market viewpoint have been continued. T6 was finally discarded, not being of commercial importance.

10. The back crosses between T1 and other hybrids with West Indian lime, a list of which was given on page 26 of my 1931 report, have been carefully gone through with Mr. Horace Rapsey, an interested planter, and only those which showed any promise retained.

11. Further crosses were made as follows during 1933-34.

						Planted in Field.	Remaining in Plots.	
W.I.	male	+	T22	female	..	30	115	
T22	"	+	W.I.	"	..	26	27	
T1	"	+	Everglade	"	..	10	47	
T1	"	+	W.I.	"	..	39	—	
W.I.	"	+	T1	"	..	22	1	
W.I.	"	+	T171	"	..	2	—	
						129	190	319

Minor Crops.

Rice.

12. It was intended to commence rice selection work on the Debe swamp and a plot was rented for the purpose, and the preliminaries arranged. The very dry weather did not, however, permit of rice planting, and Professor Wood of the Imperial College of Tropical Agriculture kindly grew the seed and forwarded twelve small samples each representing a selection of what appeared to be the dominant type. This will enable a start to be made in 1935.

Ground Nuts.

13. Considerable interest was shown in this crop particularly in the Icacos district where the soil is of a sandy nature. Experimental plots of Virginia bunch and St. Vincent running on a peasant holding at Icacos grew well and yielded 896 and 944 lb. dry nuts per acre respectively. Less favourable results were obtained at St. Augustine Experiment Station, 525 lb. and 858 lb. being the respective yields. The results from plots at Guapo and Caparo are not yet available. Two estates at Icacos planted large areas in running varieties.

14. The low yields recorded above are due to the loss occasioned by the large number of nuts which are found to be unsound at reaping. Further experimentation is necessary with varieties, soil, situation, and period of planting and reaping.

Systematic Botany.

15. Time did not permit of any new work being undertaken in connection with the preparation of the Flora of Trinidad and Tobago except that of attending to the printing of Vol. 1, part 6, Myrtales (pars), pp. 333-410, which was published in December. Some preliminary ecological studies on definite soil types were made in conjunction with Dr. H. G. Kugler to whom thanks are due for much help. Several new records of plants were obtained during these studies and Attalea Cohune, the Cohune palm, was found to be definitely a native at Whitelands and the Southern Watershed Reserve.

16. Miss Seheult, the Herbarium Assistant, maintained the collections in good order, 73 specimens being added during the year.

17. Mr. V. Fitzgerald made a study of the grasses in connection with his work on froghoppers, and thanks are due to Professor H. S. Hitchcock of the Smithsonian Institute for assisting with the identification of difficult species.

18. Thanks are due to the Directors of Kew and the New York Botanical Gardens, and to Messrs. Sandwith, Killip and Gleason for assistance with identifications.

19. At the request of the Conservator of Forests, all material of the genus *Pisonia* was sent to Dr. Burt-Davy at Oxford. *Amasonia*, *Bouchea* and *Citharexylum* were sent to Dr. Gleason on request for special study, and were cited by Mr. H. N. Moldenke in his *Monographs of the Genera*.

Visit to Grenada.

20. A visit of two weeks duration was made to Grenada in May, particularly for the purpose of lecturing to a Teachers' Conference and for matters dealing with the Citrus and Banana industries. Definite reports on these subjects were submitted.

Meetings and Demonstrations.

21. Lectures were given at meetings of the Agricultural Society, and the Diego Martin and Naparima District Agricultural Societies.

22. Demonstrations at the St. Augustine Nurseries and Experiment Station were given to the Fyzabad, Chaguanas and Diego Martin Agricultural Societies and to the Horticultural Club, to the Agricultural Advisers, and to many private individuals.

R. O. WILLIAMS,
Assistant Director of Agriculture.

REPORT OF AGRONOMIST FOR 1934.

The report may be divided into the following sub-heads:—

- I. Cacao Experiments at River Estate.
- II. Marper Estate.
- III. Manurial Experiments on Private Estates.
- IV. Experiments in connection with Coconut Wilt.

I.—CACAO EXPERIMENTS AT RIVER ESTATE.

2. The experimental work at River Estate consists of:—

- (a) Distance Spacing Experiments.
- (b) Propagation Experiments.
- (c) Seedlings from Heavy Bearing Tree No. 4927.
- (d) Colour of Pods Experiment.
- (e) Manurial Experiments.

3. All results are computed for the experimental year, *i.e.*, from 1st September of one year to 31st August of the following year.

Distance Spacing Experiments.

4. The Distance Spacing Experiments comprise two sections in Field 18: (i) plots planted in 1914, and (ii) plots planted in 1922.

5. *Experiments Started in 1914.*—Four plots of approximately one acre each were planted with seedlings, one year old in October, 1914, at distances of 12, 14, 16 and 18 feet apart, respectively. The seedlings were raised in bamboo pots from mixed seed obtained from heavy-bearing trees of the Forastero type which produced large beans of good quality. Immortal trees were planted at distances of 24, 28, 32 and 36 feet apart, respectively, for shade in the centre of four cacao trees.

6. *Results.*—Cropping started in 1918 and for the first six years the plot planted with cacao trees 12 feet apart, gave the highest yield per acre. From 1924 to 1931, with one exception in 1929, the highest yield was obtained for the plot planted 14 feet apart. In 1932 and 1933, the plots planted at 16 and 18 feet apart, respectively, gave the highest yields, which shows that with increasing age the trees planted further apart are bearing more heavily. In 1932, the plot planted at 12 feet had apparently reached its maximum production. It was then converted into a manurial experiment and super-phosphate of lime in varying quantities has been applied annually to the sub-plots. The results for this plot being no longer comparable, they are omitted. The average yields for 17 years (1918-34), *i.e.*, from the first year of fruiting, for the plots planted 14, 16 and 18 feet apart, are given below.

Average Yield for 17 Years (1918-34).

	14×14 ft. 227 trees.	16×16 ft. 173 trees.	18×18 ft. 130 trees.
Lb. commercial cacao per acre per annum ..	448	395	370

7. From the above results it will be seen that after 17 crops the average yield for the plot planted 14 feet apart is still appreciably higher than those for the plots planted at 16 and 18 feet. During the past five years, the crops for the wider plantings have been steadily increasing and the results shown below are interesting.

	Lb. Commercial Cacao per acre per annum.		
	14×14 ft.	16×16 ft.	18×18 ft.
5 years average (1919-23)	220	135	123
5 years average (1924-28)	531	451	397
5 years average (1929-33)	653	647	626
1934	567	537	535

These results indicate that there is very little difference in the average yields of the various plots for the five-year period 1929-33 or for 1934. The total yields to date, in pounds commercial cacao per acre are as follows :—

14 feet apart.	16 feet apart.	18 feet apart.
7,610	6,716	6,289

8. *Experiments Started in 1922.*—Three plots of approximately one acre each were planted without Immortel shade, in July, 1922, with seedlings one year old at distances of 6, 8 and 10 feet apart, respectively. The seedlings were raised in a nursery and each plot contains :—

40 per cent. of trees raised from Tree No. 808 of Field 5.				
30	do.	do.	1285	do.
15	do.	do.	716	do.
15	do.	do.	646	do.

These parent trees are a good type of Forastero and heavy bearers.

9. *Results.*—Cropping started in 1926, and the average yields for nine years (1926-34), show that the plot planted 6 feet apart has given the highest yield. It may be mentioned, however, that the soil on which the trees are planted 10 feet apart is of inferior quality.

Average Yield for 9 Years (1926-34).

	6×6 feet.	8×8 feet.	10×10 feet.
	1,210 trees.	680 trees.	436 trees.
Lb. commercial cacao per acre per annum	.. 332	283	143

10. The average yield for the first nine years for the plot planted 6 feet apart is slightly better than that for the plot planted at 12 feet in the first experiment at the same age, *i.e.*, 332 against 322 lb. of commercial cacao per acre per annum. Likewise, the plot planted 8 feet apart has given a better yield than the plot planted at 16 feet, *viz.* : 283 against 211 lb. of commercial cacao per acre per annum.

Yield for 1934.

	6×6 feet.	8×8 feet.	10×10 feet
	.. 497	600	286
Lb. commercial cacao per acre per annum	.. 497	600	286

11. All the plots have given an increase in yield on the previous year. The plots planted at 6 and 8 feet apart have produced 85 and 144 pounds more commercial cacao per acre than the plots planted at 12 and 16 feet, respectively, at the same age.

Propagation Experiments.

12. The object of this experiment is to test the comparative merits, under estate conditions, of seedlings, budded and grafted cacao trees. Six plots of approximately one acre each, were planted in November-December, 1914. Full particulars of the experiments are to be found on page 30 of the Annual Report for 1931.

13. *Results.*—The average results for 17 years (1918-34), from the first year of bearing and for 1934, are as follows :—

				Lb. Commercial Cacao per acre per annum.	
<i>With Immortel Shade.</i>				1918-34.	1934.
(a)	Budded at Stake	..	..	.. 416	567
(b)	Budded in Nursery	..	..	.. 376	536
(c)	Seedlings at Stake	..	..	.. 412	426
(d)	Grafted	..	..	.. 395	516
<i>Without Immortel Shade.</i>					
(e)	Budded at Stake	..	..	.. 357	496
(f)	Seedlings at Stake	..	..	.. 387	577

From the above it will be seen that, on the section planted with Immortel shade, the budded and grafted plots, as for the previous year, gave a higher yield than the seedling plot. The average yields for seventeen crops, from the time the trees came into bearing, show that the plot budded at stake has, now for the first time, exceeded the yield of the seedling plot and that the other budded and grafted plots are gaining ground. In the section without Immortel shade, the seedling plot is still producing larger crops than the budded plot.

Seedling from Heavy Bearing Tree No. 4927.

14. The average yield of this parent tree for four years (1913-16) was 332 pods per annum. In 1917 a plot of 178 stakes was planted with seed from this tree. The average yield of the progeny for eleven years (1924-34) amounted to 615 lb. of cured cacao per acre. In 1934 it produced 745 lb. of cured cacao or four and a half bags per acre.

Colour of Pods Experiment.

15. The object of this experiment is to try and ascertain :

- Whether cacao trees raised from parent trees bearing yellow pods are more, or less prolific than those raised from trees bearing red or dark red pods. This experiment is being made with both seedling and budded trees.
- Whether a better yield per acre would be obtained by having the two trees at the same stake, one raised from trees producing yellow and the other dark red pods. This experiment is also being made with seedling and budded trees.

16. There are two plots of budded trees. On one plot, buds from trees bearing yellow and dark red pods are on separate stock, on the other, both buds are on the same stock. The plants required were raised in a nursery and planted out in July, 1921, in part of Field 25 when the plants were one year old. There are 50 cacao trees in each plot, spaced 13 feet apart, without Immortel shade,

17. *Results*.—The average yield for eleven years (1924-34), *i.e.*, from the first year of bearing and for 1934 are given below :—

				<i>Lb. Commercial Cacao per acre per annum.</i>	
				1924-34.	1934.
(a)	Seedlings from <i>yellow</i> pods	..	..	340	702
(b)	Seedlings from <i>light red</i> pods	..	..	267	491
(c)	Seedlings from <i>dark red</i> pods	..	..	321	553
(d)	Single bud from <i>yellow</i> pods	..	..	307	842
(e)	Single bud from <i>light red</i> pods	..	..	308	534
(f)	Single bud from <i>dark red</i> pods	..	..	701	959
				<i>Yellow.</i>	<i>Red.</i>
(g)	Two buds on same stock, one <i>yellow</i> and one <i>red</i>	..	..	117	317
(h)	Two buds on separate stock, one <i>yellow</i> and one <i>red</i>	..	..	124	196
(i)	Two seedlings at same stake, one <i>yellow</i> and one <i>red</i>	..	..	58	199
				434	589
				320	565
				257	427

From the results recorded above it will be seen that the budded plants have given better yields than the trees raised from seed, both for the eleven-year period and for 1934. The budded plots for trees bearing dark red pods have given very high yields, *viz.* : four and six bags of commercial cacao per acre for the eleven-year period and for 1934, respectively, and these yields are much better than those of any of the other plots. It will also be observed that no advantage has been gained by planting two budded or two seedlings at the same stake, and that the yield for the red is greater than that of the trees bearing yellow pods.

Manurial Experiments.

18. *Experiments with Superphosphate of Lime*.—These experiments are being conducted on the plot planted 12 feet apart, of the Distance Spacing Experiments, in Field 18. The third application of fertiliser was made in March, 1934 and the yields for the second year have been recorded. The results of the first crop after manuring have been reported by Mr. McDonald, (Third Annual Report on Cacao Research, 1933, pp. 46-48). It is there stated that the statistical analysis of yield data shows that there has been an increase in yield due to phosphate manuring of nearly 45 per cent. This large increase is distinctly suggestive, although it is impossible to show that it is statistically significant. The lack of statistical significance is attributed largely to the type of lay-out adopted (namely, a 3×3 latin square), the available area being too small to contain a 4×4 square. The results of this experiment have served a very useful purpose in that they have clearly indicated the drawbacks of a single small latin square as a type of field lay-out for manurial experiments on cacao. The yields for the second crop, however, have recently been obtained and they show that the application of phosphates on this area is significant.

19. *Experiment to Test the Gross Effects of Applications of Nitrogen, Potassium and Phosphorus*.—The experiment consists of a complete manurial trial on established cacao, of relatively uniform age and in full bearing. The site is a normal flat alluvial field at River Estate. The design is a 4×4 latin square to test the effects of nitrogen and potash upon which is super-imposed a half-plot treatment of phosphate. Each main plot consists of 16 seedling trees in two rows of eight. The half plots are 8 trees in two rows of four.

20. Soil analyses made by the Chemical Section of the Cacao Research Staff prior to the commencement of the experiment demonstrated that compared with normal standards both phosphate and potash were deficient. The phosphate status was equal to that of other poor bearing areas but the potash deficiency was much more marked.

21. Natural yield records for two years previous to the application of the manures were obtained.

22. *Results*.—Crop yields for the 1st experimental year have been recorded. The Analysis of variance without the use of previous records show that of the main plot treatments only applications of potash appear beneficial and that the result would occur by chance less than once in twenty trials and may be considered significant.

23. The interaction of potash and phosphate is large and positive but not quite significant.

24. Making use of previous yield records for 1931-32 to correct those of 1933-34 precision has been increased four-fold for the main plot units and the Analysis of Variance so corrected shows that potash is still the only treatment which is generally significant. Nitrogen depressed the yields by a very nearly significant amount. The effect of phosphate is high, positive and nearly significant. The same applies to the interaction of potash and phosphate which suggests that on this area phosphate is beneficial only when the potash deficiency has been made up. There is now no interaction between nitrogen and phosphate. Details of this experiment will be found in the Fourth Annual Report on Cacao Research, 1934.

Trenching Experiments.

25. The Trenching Experiments are being made in Fields 3A and 20.

26. *Experiment in Field 3A*.—The cacao trees are 60 to 65 years of age, planted 15 feet apart and sparsely shaded with Immortel trees. Three plots aggregating 6.55 acres were trenched 2 feet wide by 18 inches deep, filled with available material found on the spot and covered with earth from the trenches from January to May, 1931, at a cost of \$18.96 per acre. Two other plots comprising 2.9 acres were similarly trenched and 18 tons of pen manure per acre were added, from June to August, 1931, at a cost of \$31.29 per acre. The *natural* yield of each plot for one year is known and two crops subsequent to trenching have been obtained.

27. *Results.*—A slightly lower yield was obtained for each plot trenched with no pen manure added, whereas, the plots trenched with pen manure added gave an appreciably higher yield than the respective yields of the plots previous to trenching. The yields of the plots are as follows :—

<i>Trenched without Pen Manure.</i>				<i>Trenched with Pen Manure.</i>			
<i>Lb. Commercial Cacao per acre.</i>				<i>Lb. Commercial Cacao per acre.</i>			
<i>Natural Yield.</i>				<i>Yield after Trenching.</i>			
1932	..	..	409	1934	..	..	392
<i>Average.</i>				<i>Average.</i>			
1933-34 .. 393				1933-34 .. 578			

28. *Experiment in Field 20.*—The cacao trees are 30 to 35 years old, planted 12 feet apart, without Immortel shade. A block of 2.7 acres, comprising four plots was trenched from June to September, 1932, and heavily pen-manured, at the rate of 47 tons, costing \$49.07 per acre. This high dressing of pen manure was not intended, but when the amount actually applied was calculated it was found to be at the rate specified above. This may, however, prove to be a useful error. The *natural* yield of each plot for one year is known and two crops subsequent to trenching have been obtained.

29. *Results.*—The trenched plots gave an increase of 108 lb. of cured cacao per acre for 1933 over its *natural* yield and a further increase of 96 lb. for 1934. The average yields for the four plots are as follows :—

<i>Natural Yield.</i>				<i>Yield after Trenching.</i>			
1932	..	..	561	1934	..	..	765
<i>Average.</i>				<i>Average.</i>			
1933-34 .. 717				1933-34 .. 717			

30. *Experiment in Field No. 21.*—Manurial Experiments are now being conducted, in this field, by Officers of the Cacao Research Scheme.

31. *Mulch Experiments.*—The plots marked out in Field No. 25, for mulching trials, are treated with fertilisers, and one half of each plot is mulched. The *natural* yield of each tree has been recorded for 1923 and 1933, respectively. The records are being kept for the Officers of the Cacao Research Scheme.

II.—MARPER ESTATE.

32. *Cultivation.*—Fields 1 to 5 were hoe-weeded from February to April and cutlashed from August to October. All the other fields were cutlashed twice during the year. Ground shade has been planted where necessary. All missing cacao trees were supplied with seedlings from heavy-bearing trees on River Estate. Young cultivations have received continued attention.

33. *Pruning.*—The whole estate was more or less lightly pruned according to the condition of the trees in each field from April to June. Suckers were cut out later in the year.

34. *Draining.*—A few new drains were dug, where necessary, in fields 6, 7, 8 and 9, and the earth roundridged. All old drains were cleaned with a hoe.

35. *Windbreaks and Hedges.*—These have continued to make good growth. They are now well established and need little attention.

36. *Thrips.*—Thrips were scarce during the year in fields 1 to 5 which were sprayed with Bordeaux Mixture, but they were more prevalent in parts of fields 6 to 10, the unsprayed section of the Estate. In this connection it was stated in previous reports that the advent of Thrips coincided with the cutting out of Immortel shade trees in fields 1 to 5, in the shade reduction experiments for Witchbroom control. Twenty-five and 16 2/3 per cent. of the Immortel population were cut out in certain sections of these fields in 1930 and again in 1931, but as this treatment was found to be too drastic, from a cultural point of view, no shade trees were cut out subsequently. Not only Thrips made their appearance in 1931 and were severe in December 1932 to January 1933 but the cultivation generally suffered considerably from exposure and an appreciable decrease of crop resulted. It was accordingly decided to try spraying, this block, with Bordeaux Mixture, as a control for Thrips. The results of this treatment are most encouraging as will be seen from the figures below :

Yields. lb. Commercial Cacao per acre—1st September to 31st August.

Period.					Fields 1 to 5.		Fields 6 to 10.		Average for whole Estate 92.5 acres.
					47.8 acres (1)		Not manured 27.7 acres.	Manured Section 17.0 acres (2.)	
1930-31	..	..	..	..	411		417	495	428
1931-32	..	..	..	..	259		280	320	276
1932-33	..	..	..	..	294		389	514	363
1933-34	..	..	..	..	291		262	297	283

(1) Sprayed in May, 1933 and 1934.

(2) Manures applied May, 1930, 1932 and 1934.

37. From the figures recorded above it will be seen that for 1930-31, before the shade reduction had affected the cultivation, the yields for fields 1 to 5 and the non-manured section in fields 6 to 10 were practically the same and only slightly inferior to the manured section. For 1931-32, a poor year, fields 1 to 5 show a decrease of 37 per cent. as against 33 and 35 per cent. for the two sections of fields 6 to 10 on their respective crops for the previous year. For 1932-33, a good year, the yields for fields 1 to 5 are 30 per cent. less than for 1930-31. This decrease of crop is attributed to Thrips and the poor condition of the trees resulting from the cutting out of shade. Although the trees were sprayed with Bordeaux Mixture in May 1933, this treatment could have no effect on the trees and still less on the crop, for the year ending 31st August, 1933. On the other hand the non-manured section of fields 6 to 10 gave only 10 per cent. less and the manured section 4 per cent. more crop than for 1930-31. Now, for 1933-34, the first year on which the Bordeaux Mixture could have had any effect we find that not only has the condition of the trees improved to a very marked extent but the crop of the previous year has been maintained whereas the non-manured and manured sections of fields 6 to 10 show a drop of 32 and 42 per cent. on the previous crop. It might here be stated that 1934 was, probably, the worst cacao year experienced in Trinidad. Moreover, eight months records to 30th April, 1935, show that fields 1 to 5 (sprayed with Bordeaux Mixture) have already exceeded their highest crop, that of 1930-31, by 1,000 pounds of commercial cacao whereas the crop for fields 6 to 10, for the same period, has barely reached its best crop. A record crop for Marper is clearly indicated and this is undoubtedly due to the control of Thrips and to the striking recovery of the trees in field 1 to 5, since spraying with Bordeaux Mixture was started. The cost of spraying including materials on the estate was \$4.58 per acre as against \$7.03 in 1933. This large reduction in the cost of spraying is due chiefly to the labourers being more efficient, doing more work and using less liquid to spray a tree, also to having dispensed with the use of fish glue as a sticker. Although fish glue added to Bordeaux Mixture does give a better spread and makes it more adhesive, the additional cost is not warranted.

38. Cacao Beetles, Squirrels, and Rats were scarce. Black pods (*Phytophthora*) were not plentiful except in the month of December.

39. *Rainfall*.—The rainfall for the year was 83.65 inches against 141.88 inches in 1933 and 101.73 inches in 1932.

40. *Witchbroom*.—The usual monthly rounds were made and all diseased tissues cut out and burnt. The total number of diseased tissues found for the calendar year was 194,459 or 2,102 per acre, a decrease of 14 per cent. on the previous year. The heaviest Witchbroom incidence occurred, as in the previous year, in the month of March, when 76,638 diseased tissues were cut out and destroyed. The cost of cutting and burning diseased material was \$4.13 and supervision \$0.91 per acre, respectively, a reduction of \$1.16 per acre on the previous year.

41. *Crops*.—The crop reaped for the year was 32,800 lb. of plantation cacao and 823 lb. of black cacao including siftings. The produce is sold through the Cocoa Planters' Association of Trinidad, Ltd., and the price realised for the plantation cacao was \$6.49 per fanega, as against \$5.73 per fanega in 1933. The total crops (plantation and black cacao) in bags of 165 lb. for the five completed years since the property was purchased by Government, have been as follows:—

1930	1931.	1932.	1933.	1934.
251	196	211	202	204

The loss of crop due to matured pods affected with Witchbroom is 1.33 per cent. over the whole Estate.

42. *Buildings, Yard and Stock*.—The barrack rooms have been re-plastered and all other buildings on the Estate are in good repair. A new concrete step leading to the large cocoa house, has been erected. An iron tank of 8,000 gallons capacity for providing a wholesome supply of drinking water for the labourers was put up by the Public Works Department. Marper contributed \$95.84 towards the expenses. The yard and surroundings have been kept in good condition. A mule was purchased at the beginning of the year.

43. *Roads and Bridges*.—Eight concrete bridges have been constructed over main drains. One thousand and fifty-five feet of new crooking roads were bouldered and gravelled with material obtained on the Estate and all roads have been kept in good repair.

44. *Gros Michel Banana Plots*.—Three small plots aggregating 666 holes, were planted in May with Gros Michel Banana suckers and a fourth in October, 1934. These plots are situated on slopes and tops of ridges where cacao had died out, and although not favourably situated it is expected that useful information will be obtained from these plots. The plants on the lower slopes have made fair growth but those on higher ground are more backward. The cost of establishing and maintaining the cultivation to 31st December, 1934, is \$139.42.

Experimental Work.

45. The chief objects of the experiments are to ascertain the effect of the various treatments on Witchbroom incidence and on crop production. All results are given for the experimental year, *i.e.*, from 1st September of one year to 31st August of the following year. The crop yields are given in pounds commercial cacao and Witchbroom incidence, in number of affected material per acre.

46. The experiments may be classified under four heads:—

- (a) Cultivation Experiments.
- (b) Manurial and Lime Experiments.
- (c) Spraying Experiments.
- (d) Other Experiments.

(a)—Cultivation Experiments.

47. The Cultivation Experiments consist of draining and shade reduction on (i) flat lands or vega, and (ii) on undulating lands. Details were given in the annual report for 1930. The first and second instalments of shade trees were cut out in 1930 and 1931, but this treatment proved too drastic, from a cultural point of view, and no shade trees were cut out subsequently. The drains were dug in 1930, re-opened in 1932, and cleaned out with a hoe in 1933 and 1934. The average results for four years ending 31st August, 1934, are as follows:—

48. *Results on Vega*.

	50% Shade Reduction.		33 $\frac{1}{3}$ % Shade Reduction.	
	Crop.	Witchbroom.	Crop.	Witchbroom.
Drains 25 feet apart	430	5,534	332	2,987
Drains 50 feet apart	314	3,840	419	4,698
Drains 100 feet apart	177	1,221	184	1,231
No drains	218	2,087	272	1,928

(a) *Spacing of Drains*.—The results recorded above show that draining has had no effect in controlling Witchbroom. It has been observed, however, that the plots showing the highest Witchbroom incidence are those adjoining the River and it is highly probable that their situation has a greater effect on Witchbroom production than the actual draining of the plots. The results show that lack of drains has adversely affected the crop.

(b) *Shade Reduction*.—The results tend to show that Witchbroom incidence is higher on the plots with greater shade reduction. With regard to crop production, there is not much difference in the average yields for the plots on which 50, or 33½ per cent. of shade trees were cut out, but the advantage is in favour of the smaller shade reduction.

49. Results on the Undulating Land.

	33½% Shade Reduction.		No Shade Reduction.	
	Crop.	Witchbroom.	Crop.	Witchbroom.
Drains 25 feet apart	364	2,377	307	1,467
Drains 50 feet apart	366	1,051	301	1,119
Drains 100 feet apart	200	1,346	421	1,242
No drains	283	1,811	387	1,093

(a) *Spacing of Drains*.—The results tend to show that the spacing of the drains has had no effect on Witchbroom control. The plots showing highest Witchbroom incidence are situated on the lower slopes and it is probable that the altitude and situation of the plots have a greater influence on Witchbroom incidence than the spacing of the drains. With regard to crop, the spacing of the drains has had no effect on crop production.

(b) *Shade Reduction*.—The results show that there has been less Witchbroom where no shade has been cut out. With regard to crop production, as in the previous year, the results show a better average yield for the section on which no shade has been reduced.

(b)—Manurial and Lime Experiments.

50. The manurial and lime trials on 17 acres of land, partly vega and partly undulating, are being made under ordinary shade conditions. Details of the trials are given in previous annual reports.

51. *Results*.—The crop yields and Witchbroom incidence have been recorded from 1931 to 1934—a period of four years. The results, for this and previous years, show that the fertiliser treatments have had no effect on Witchbroom incidence.

(c)—Spraying Experiments.

52. The object of these experiments is to try and discover an efficient fungicide for the control of Witchbroom. Liquid sprays and dusts have been tried with little or no success.

Liquid Spraying.

53. Spraying with (i) Cooper's Fungicide, and (ii) Bordeaux Mixture, twice annually; and (iii) Cooper's Vermorite, monthly, has been continued during the year. The spraying with Bordinette was discontinued in 1934.

54. Results.

(i) *Cooper's Fungicide*.—The average Witchbroom incidence for three years after spraying is practically ten per cent. less than for the control, but the actual decrease of brooms, viz.: 340 per acre is small compared with the cost of two sprayings per annum. With regard to crop production there is a slight increase for the sprayed plot on the control.

(ii) *Bordeaux Mixture*.—A decrease in Witchbroom incidence, for the three years after spraying, has been obtained for the control plot against an increase for the sprayed plot. Spraying with Bordeaux Mixture has, therefore, not assisted in controlling Witchbroom. With regard to crop production, the sprayed plot has yielded 90 lb. of cured cacao more per acre per annum than the control.

(iii) *Cooper's Vermorite*.—In 1932 and 1933, the plots sprayed monthly with Vermorite, showed a decrease of Witchbroom incidence against an increase for the controls. This year there has been a further appreciable decrease in Witchbroom for the sprayed plot which shows that monthly spraying with this fungicide has successfully decreased Witchbroom incidence, but the cost of monthly sprayings is not practical and prohibitive.

The crop yields and Witchbroom incidence for 1934, compared with 1931, i.e., before spraying are as follows:—

	Year.	Lb. Commercial cacao per acre.		Witchbroom.
		1931	1934	
Vermorite	1931	619	—	1,157
Do.	1934	629	—	505
Control	1931	900	—	405
Do.	1934	627	—	710

From the above results it will be seen that the plot sprayed with Vermorite has produced a slight increase in crop on 1931, whereas the control or unsprayed plot shows a decrease of 30 per cent.

Dusting Trials.

55. *Olite Sulphur*.—Monthly dustings with Olite Sulphur were continued during the year on a plot of 8.20 acres. Results for three years show that these treatments have not assisted in controlling Witchbroom and they will be discontinued.

(d)—Other Experiments.

56. These experiments consist of:

- (i) Topping or reducing height of trees.
- (ii) Mature pods affected with Witchbroom.
- (iii) Trees not affected with Witchbroom.

57. *Reducing Height of Trees*.—The object of this experiment is to facilitate the search for and incidentally reduce the cost of cutting out Witchbroom, also to observe the effect on crop production. One acre containing the tallest cacao trees was divided into two equal parts. The trees on one of the plots were topped in July, 1930, at 12 feet, and on the other at 16 feet from ground level. Two plots of one acre each, on either side of the treated plots, are kept as controls.

58. *Results.*—Cutting back the trees at 12 and 16 feet from ground level has not caused a reduction in Witchbroom incidence, but the cost of searching for and cutting out brooms has been slightly reduced. The crops, for the first two years, after the trees were cut back show a decrease in yield of 17 and 33 per cent. for the plots topped at 16 and 12 feet, respectively. Three to four years after the trees were topped, the new growth had attained the height of the original branches cut off and the crops for the third and fourth years have returned to normal. The slightly lower cost of searching for and cutting out Witchbroom does not compensate for the loss of crop recorded.

59. *Mature Pods affected with Witchbroom.*—In order to ascertain the loss of crop due to mature pods affected with Witchbroom, records from various plots have been kept during the past four years. Plot were selected which, owing to their situation, were expected to produce high, medium and low Witchbrooms incidence.

60. The average results for four years to 31st August, 1934, are as follows:—

HIGH INCIDENCE.			
	Total Pods.	Affected Pods.	Per cent. Pods Affected.
Two plots (4 years)	2,385	107	4.49
MEDIUM INCIDENCE.			
One plot (4 years)	2,229	41	1.84
LOW INCIDENCE.			
One plot (4 years)	4,440	43	0.97

From these results it will be seen that the loss of crop, at Marper due to mature pods affected with Witchbroom, is small, and based on the figures for the above plots it does not exceed 2.60 per cent. Records for the whole estate, however, show a loss of only 1.33 per cent.

61. *Trees not Affected with Witchbroom.*—Records of Witchbroom incidence on 4,035 individual cacao trees in the Manurial Section have been kept. From these records the number of trees which have been immune to Witchbroom for four years (1931-34) are shown below.

	Trees in Plot.	Trees not affected with Witchbroom.
Lime Series (Vega)	243	0
Nitrogen Series (do.)	483	1
Nitrogen and Potash (do.)	441	0
Nitrogen and Phosphate (do.)	473	0
Potash (Undulating)	462	4
Phosphate (do.)	494	7
Complete Fertiliser (do.)	473	18
Lime (do.)	486	16
Potash and Phosphate (do.)	480	99

From these records it will be observed that out of 1,640 cacao trees in the vega, only one tree has been immune to Witchbroom during the past four years, i.e., tree No. 1686 in the Nitrogen Series. Six brooms were found in 1934 on tree No. 724 of the Nitrogen plus Phosphate Series. No brooms had been found on this tree for three years (1931-33). The number of trees resistant to Witchbroom on the undulating land section is being gradually reduced from year to year.

62. *Progeny of Trees highly Resistant to Witchbroom.*—Seed from trees Nos. 1686 and 724, respectively have been sown in highly infested areas to ascertain whether their progeny will be immune to Witchbroom. Twenty-five other trees which so far have shown high resistance to Witchbroom are kept under close observation.

III.—MANURIAL EXPERIMENTS ON PRIVATE ESTATES.

63. Manurial experiments are being conducted under the supervision of the Department of Agriculture in co-operation with Messrs. Imperial Chemical Industries, Ltd. The latter supply the fertilisers but the cost of application and of keeping records of the experiments is borne by the proprietors.

Manurial Experiments on Coconuts.

64. *Experiments at Endeavour Estate.*—This Estate is situated at Chaguanas and is typical of a large area of old sugar-cane land planted in coconuts. The soil is flat, deep, well drained and varies from a sandy loam to a clay loam. The trees come into bearing late but yield an average crop of 3,000 to 4,000 nuts per acre, per annum, when they are 18 to 20 years old.

65. *Experiments with N, N+K, and N+P+K.*—The object of these experiments is to ascertain the pecuniary benefit, if any, to be derived from applying a normal dressing of Sulphate of Ammonia alone, of Ammonia plus Potash, and of Ammonia plus Potash plus Phosphate. These experiments were started in December, 1925, on whole fields of 8 to 9½ acres each. The trees were 13 to 15 years old and the crops of each field previous to manuring were known. The fertilisers were applied every second year from December 1925 to 1934, at the following rates per acre:—

Field 1 ..	..250 lb. Sulphate of Ammonia.
Field 7 ..	{ 250 lb. Sulphate of Ammonia. 100 lb. Sulphate of Potash.
	{ 250 lb. Sulphate of Ammonia.
Field 4 ..	{ 150 lb. Rock Phosphate. 100 lb. Sulphate of Potash.
Field 2 ..	..Control—No Manure.

66. *Rainfall.*—The average annual rainfall on the estate for the past three years is 79.36 inches, and for the previous five years, 65.84 inches. The rainfall for 1933 was very high for the district, being 93.80 inches, and a record crop was obtained for the year ending 30th June, 1934.

67. The average yields obtained for the first period of five years (1927-31) and for the subsequent three years (1932-34) after manuring, respectively, have been calculated to ascertain whether the results of the first five-year period will be maintained or improved during the subsequent five-year period.

68. In working out the results, coconuts have been valued at \$14.50 and \$8.53 per 1,000 for the two periods, 1927-31 and 1932-34, respectively, being the average price realised for the produce for these periods. Similarly, the cost of manuring has been computed from the actual cost of the fertilisers and of their application for each period.

69. *Results.*—The results obtained show :

- (a) That for the first five-year period after manuring, *i.e.*, to 30th June, 1931, all the fields have given an increase in crop on their respective *natural* yields and that the increase for the manured fields is greater than that for the control field.
- (b) That the average crop for the next three years (1932-34) has also given a further increase for manured fields 1 and 4, over and above that of the control field.

For the first five-year period, after manuring (1927-31), Field 1 (Sulphate of Ammonia only) gave the largest increase of crop, followed by Field 7 (Sulphate of Ammonia plus Sulphate of Potash), and Field 4 (Complete Fertiliser), *viz.* : 702, 490 and 318 nuts per acre, per annum, respectively. For the subsequent three years (1932-34), the increased yields are 1,088, 173 and 488 nuts per acre for Fields 1, 7 and 4, respectively, *i.e.*, the Field treated with Sulphate of Ammonia only, has given a decidedly greater increase of crop than the others.

The beneficial results due to manuring have, therefore, not only been maintained but they have been further enhanced.

70. The pecuniary results per acre per annum to date, calculated on the actual price realised for the produce for the two periods are set out below :

		Average, 5 Years 1927-31.	Average, 3 Years. 1932-34.
Field 1 (Sulphate of Ammonia only)	.. ..	\$ 6.59	\$ 7.10
Field 7 (Sulphate of Ammonia plus Sulphate of Potash)	.. ..	2.10	—2.00
Field 4 (Complete Fertiliser)	.. ..	—1.06	+0.01
Value of nuts per 1,000	.. ..	\$ 14.50	\$ 8.53

From these results it is evident that notwithstanding the low price of the produce for 1932-34, satisfactory results have been obtained for the field treated with Sulphate of Ammonia.

IV.—EXPERIMENTS IN CONNECTION WITH COCONUT WILT.

71. A series of experiments was started in 1931 on the Perseverance Section of the Waterloo Estates, with the object of ascertaining the cause of Wilt disease in the coconut palm. The experiments consist of :—

- (a) Manurial trials.
- (b) Trimming of leaves and firing crown of palm.
- (c) Preserving moisture during dry season.
- (d) Removing crop from the palm.
- (e) Dusting trials.

72. Regular inspections were made during the year by Officers of the Department and records have been kept of Wilt affected trees.

73. A detailed report on the manurial trials will be found in "Tropical Agriculture" Vol. XI, No. 12 pp. 313-315. The conclusions are that the yield of coconuts may be increased under the conditions of Felicite Hall both by the application of lime and by the application of mixed fertilisers. It is significant that 10 tons of lime and 9 cwt. of artificials per acre give as large an increase as double those quantities. Further, both lime and artificials cause their respective increases in yield entirely independently of one another. In neither case, for mature coconuts, does an increase in yield manifest itself until two years after application.

J. DE VERTEUIL,
Agronomist.

GOVERNMENT STOCK FARM, TRINIDAD.

General.

Dr. J. L. Shannon, the Assistant Officer in Charge proceeded to Tobago on official duty (10 days) during the month of January : this officer acted for the Officer in Charge when he visited Grenada (10 days) in May, St. Lucia (10 days) in June on official duty and also during the absence of the Officer in Charge on duty leave in August and September (6 weeks) to attend the International Veterinary Conference in New York.

2. The Farm suffered severely from the effects of the drought from February to the middle of August : the lowest rainfall recorded was .07 inches in April and the highest 11.83 inches in November. The total rainfall for the year was 47.02 inches, which was just a little more than half the amount of the 1933 rainfall (88.47 inches).

3. The grazing during the long dry spell was very poor and all the animals were unable to obtain their necessary bulky food, as their was very little cut fodder to make up for the roughage from grazing. It was necessary to turn the Zebu herd into grassfields for short spells daily, and young seedling canes had to be cut down to be used as roughage for the dairy herd owing to the poor grazing and the lack of cut fodder from the grass and uba fields : further for two months we had to send a lorry to Valencia and Maracas with a grass cutting gang to obtain fodder—very inferior in quality, but the best available—for the stock.

Water Supply.

4. The water supply was most satisfactory and this was due to the fact that it was not so dry in the heights of Maracas, so that the St. Joseph River was never too low to stop the water flowing into the intake pipe for the Blake's Ram. Inconvenience was, however, experienced by the sand silting up around the intake pipe, but the Ram worked excellently as soon as the sand was cleared away. The repairs carried out by the Public Works Department in 1933 to the dam in the river were responsible for the good results as well.

Cattle.

5. The strength of the pure bred Holstein herd was maintained by purchasing locally a pure bred mature bull, two cows and three well bred bull calves, but no cattle were imported from abroad. The pure bred Holstein bull "Prince Paul Rocharm" was sent to Waterloo Estate in exchange for the pure bred bull "Segis Echo Rooker". The pure bred bulls "Huggins" and "Prince Johanna Hartog" stood for service at San Fernando (Ste. Madeleine Sugar Company). The well known bull "King Butter Girl Walker"—calved 1921—was again used for breeding all pure bred cows, as well as selected grade cows and heifers belonging to the Farm and from outside at the Farm. During the year the imported pure bred bull "Count Abbekirk Wayne" died.

6. Small half bred, three-quarter bred and seven-eighths bred Zebu-Holstein grade herds made up of cows and heifers were kept in separate paddocks, and selected bulls of the same breeding were turned out with each lot. This policy had to be abandoned during the dry weather, but as soon as the rains started each Zebu-Holstein grade herd was again turned out into a paddock.

7. The pure bred Holstein bull "Rutchers 11" was kept at the Farm during the year and was used for breeding certain grade cows not included in special paddocks.

8. The first step to introduce Sussex cattle into Tobago from the small herd at the Farm was taken during the year when two bulls, the originally imported bull and his first son, were sent over to stand for service at the Government Farm and at Studley Park. The younger son was kept here at the head of this herd, and during the year there were added to the herd 1 heifer calf (pure bred), 2 heifer calves (three quarter bred), 1 heifer calf and 3 bull calves (half bred).

9. The dairy Zebu herd was again maintained separately from the larger working Zebu herd, and the Indian method of milking cows and heifers for about two weeks before calving was introduced in order to get better results with them at the pail when they calved down and the calves are removed. As a matter of fact, milking before calving has been introduced generally, and is being given a trial with the dairy herd as well.

10. The practice of working all the service bulls at the Farm—pure bred and grades—has been continued and this regular exercise makes the bulls more manageable and quite active. Bulls that are regularly turned out to pasture are not worked as regularly as permanently stabled ones.

11. Forty-two privately owned cows were bred to pure bred bulls (39 to the Holsteins and 3 to the Zebus) at a fee of \$2.00 for the Holstein and \$1.80 for the Zebu, in addition to Government Farm cows.

12. A pure bred Zebu bull, Naipaul No. 177, 8 years, bred at this Institution, was purchased from Mr. Frank Agostini to stand at the head of the working Zebu herd to replace the old bull, Babool 11. This bull has improved wonderfully in condition and is a great acquisition to the herd.

13. At the Annual Sale held on the 1st December, four grade cows averaged \$85.00, 17 grade heifers \$60.00; 2 grade bulls \$65.00; 4 pure bred Zebu heifers \$50.00, 1 pure bred Zebu bull fetched \$200.00 and a young pure bred Holstein bull \$50.00.

14. Four pure bred Holstein bulls and two selected grade Holstein-Zebu bulls stood for service at the Bull's Service Station at Mucurapo for the convenience of dairy owners around Port-of-Spain. Two of the pure bred were used on the Mucurapo and the St. Ann's pastures for part of the year, a bull being turned out into each pasture every evening and removed the following morning. At the Station 214 cows were bred to these bulls and the revenue derived from this source was \$228.00.

15. The Mucurapo and St. Ann's Pastures were very parched up during the dry weather, and in the case of the St. Ann's Pasture it was necessary to supply cut fodder to the cattle. The St. Ann's Pasture was handed over to St. Mary's College in June as a recreation ground and the use of the pasture for grazing purposes was discontinued. Facilities were made for the cows on the St. Ann's Pasture to be transferred to Mucurapo. The average daily number of cattle (cows, heifers and calves) on the Mucurapo pasture was 60.

16. *Dairy Herd.*—The dairy herd produced 37,476 gallons of milk during the year. The public Institutions were supplied with 31,126 gallons, about the same as in 1933: most of the other milk was sold for feeding calves that were used for making paralytic rabies vaccine. The daily recording of the milk yield has been continued and the weekly totals transferred to a record book. The monthly butter fat testing was not carried out by the Agronomist, as this Officer was engaged on special duties during the year, but steps will be taken for this work to be done, at least every quarter, during 1935.

17. *Zebu Herd.*—There was little demand for Zebu cattle during the year and the only animals sold privately were the following:

1 pure bred Bull to Mr. McDonald (St. Vincent)	..	..	..	\$200.00
1 pure bred bull and 2 heifers to Mr. Fernandes (Forres Park)	..	..	..	370.00
				\$570.00

The amount realised for the sale of this kind of cattle at the Annual Sale was \$400.00, making the total for all sales \$970.00, or £200, less than half of that realised in 1933 (£500).

18. During the year 166 cows calved normally and there were 15 cases of abortion. The heavy cows were kept in the maternity wards for a month to six weeks before calving and for three weeks afterwards, if they calved to time. All aborting cows were segregated in separate stables for 2 months before they were returned to the herd.

19. *Health.*—Our greatest problem during the year was eye trouble in calves, causing inflammation of the cornea (keratitis) with ulceration. The young calves are chiefly affected and the condition appears to be fly transmitted. Treatment adopted was to avoid over-crowding, keeping pens clean and using a lot of zinc sulphate lotion on the affected eyes. There were 30 deaths on the Farm and of these 9 were due to Pneumonia and 2 to Enteritis in calves; 5 old animals died from general old age and debility.

Horsekind.

20. The thoroughbred stallion 'Lundy Light' (foaled in 1925) which was imported in 1933 died on the 10th February from internal strangles before it was possible to stand him for service. The thorough bred stallions 'Bachelor's Tut' and 'Daddy' stood for service at the Farm, when 'Bachelor's Tut' served 7 mares and Daddy 4 mares, besides the Farm mares. The thoroughbred stallion 'Nelsweep' stood for service at Cedros from 20th February to 4th May, where he served 4 mares. The thoroughbred stallion 'Knight of St. Patrick' (K.P.) stood for service in Tobago for the whole year. The fee charged for the services of these stallions in Trinidad was \$10.00 each plus 60 cents groom's fee. The farm suffered another great loss by the death of 'Daddy' on the 29th December after a prolonged attack of influenza, which eventually affected his heart. The death of these two stallions (Lundy Light and Daddy) in the same year is a great loss, but fortunately they were insured for £300 each. The Jack Donkey, Emperor 2, stood for service at the Farm where he served 10 mares. He was also sent to Hindustan Estate, Princes Town, for five weeks (March and April) where he served 7 mares. The service fee was \$7.50 plus 60 cents groom's fee, each. The younger Jack, imported from Missouri, was used for breeding to the large jenny donkeys at the Farm, as well as 3 outside jennies: the fee charged for his service was \$5.00 each plus groom's fee, 60 cents. Big Six, the small Jack used for donkey breeding, served 11 jennies during the year at \$1.00 each,

21. The thoroughbred mare Saturnia foaled a colt foal by K.P. and this foal was sold at the Annual sale to Mr. O. P. Bennett for \$170.00. The thoroughbred mare Barbara did not prove to be in foal, but was re-bred to Bachelor's Tut and was heavy in foal at the end of the year. Saturnia was also bred to Bachelor's Tut and was definitely in foal at the end of the year. The other thoroughbred mare Miranda was bred to Nelsweep but failed to hold and will be re-bred to this stallion next year. Two mares were received from the Constabulary on the 14th April, Rew's and Vitalia: they were both served by Bachelor's Tut.

22. The old half bred mares Nellie and Cavel foaled a filly by K.P. and a colt by Bachelor's Tut, respectively. Both these mares were bred to Daddy during the year. Nellie's foal died from digestive trouble, but the Cavel colt grew well and was sold at the Annual Sale for \$70.00 to Mr. F. Agostini. The brood mare Wistaria foaled a colt by K. P. and was re-bred to Bachelor's Tut. Pretty Polly foaled a mare mule foal by Emperor 2. Pretty Polly's foal realised \$45.00 at the Annual Sale, but the reserved price of \$50.00 on the Wistaria foal was not obtained and it was withdrawn. The brood mare Marama was not in foal but she was re-bred early in the year to the newly imported Missouri donkey and was definitely settled down for early foaling next year.

23. Of the three jenny donkeys purchased last year, one foaled a jack, another aborted twins and the third is due to foal early in 1935. In the case of the two common jennies only 1 foaled, but, unfortunately died due to the result of an accident. All the jennies were re-bred during the year.

Pigs.

24. No pigs were imported during the year. A Large Black Boar and a Berkshire Boar were reared from our young stock on the Farm to replace the older boars. Six young Large Black Sows and one young Boar of the same breeding were transferred to the Tobago Farm in June.

25. The number of outside sows bred to the boars at the Farm was ten and the service fee was \$1.50 plus 25 cents attendant's fee.

26. Twenty-one young pure bred pigs—Large Black and Berkshire—fetched \$271.00 at the Annual Sale, an average of approximately \$13.00. The highest prices paid were \$18.50 and \$15.50 for a Large Black Boar and a Large Black Sow respectively.

27. The private sale of young pigs during the year realised \$183.00 making a total of \$454.00 for all sales during the year.

Dairy and Mutton Goats.

28. The well known Saanen Buck Prince Perfection died during the year when standing for service at Rio Claro.

29. A Saanen ram was stationed at Marper until the end of March and then transferred to the Debe district from April until the end of the year.

30. Two young British Alpine bucks were purchased from Dr. Lyon: they arrived in utero from England—Didgemere Diabolo—and were bred by Mrs. Abbey. The Buck Whitwell Dido was transferred from Port-of-Spain to Manzanilla and his place taken by a young bred buck reared at the Farm.

31. Thirty-nine goats were bred to the pure bred British Alpine buck 'Didgemere Raven' at a fee of \$1.50 each.

32. The two young pure bred British Alpine goatlings out of the imported doe Bitterne Merle have grown well and were heavy in kid, as well as all the other does on the Farm at the end of the year.

33. A lop-eared buck was stationed in Port-of-Spain and 3 more were available for distribution at the end of the year.

34. At the Annual Sale a Saanen buck, a British Alpine buck and 3 lop-eared goats were sold for \$54.00

Black Head Persian Sheep.

35. At the Annual Sale a ram, a ewe, a ram lamb and a ewe lamb were offered for sale, but did not fetch the upset price: they were subsequently sold to Dr. Sardeman, the Veterinary Officer, Curacao, for \$125.00.

Poultry.

36. Two special White Leghorn cocks were imported from the Black Lake Poultry Farm, Egham, Surrey, England, at a cost of \$55.00. Three pens of Barred Plymouth Rocks were ordered from Canada but did not arrive until January, 1935, and a pen of the same breed was purchased from Mr. C. Fleming of Sangre Grande.

37. The breeding season was continued until the end of February and then all hatching was stopped on the Farm. With the exception of a pen of each breed that was kept for the purpose of selling fertile eggs to the public, infertile eggs were produced from the other hens until November when the pens were again made up for the new hatching season.

38. The chicks were again reared on wire until they were eight to ten weeks old, but it was observed towards the end of the year that pox of a mild nature was causing considerable trouble, and would, probably continue to do so through the 1934-1935 hatching season.

39. At the Annual Sale, 36 lots of pure bred poultry were sold for \$160.85. The number of eggs laid during the year was 4,597 and the revenue derived from the eggs sold for hatching and eating purposes was \$138.80.

40. The small Hearson's Incubator was sold to the Tobago Farm for \$20.00.

Sale of Stock.

41. The Annual Sale of Stock took place on the 1st December and the amount realised was \$2,727.85. Private sales of Stock brought in \$2,578.26, making a total of \$5,306.11 for the year,—\$200.00 less than last year

Pasturage and Stabling.

42. Arrangements were made for the pasturing and stabling of mares, jennies, cows and heifers sent to be bred to the stallions, jacks and bulls, but no general public pasture was available. Sows, ewes and does sent for breeding purposes were also provided with accommodation. The revenue derived from this source amounted to \$1,443.25.

Sugar Cane.

43. Our crop started on the 12th March and ended on the 11th of April. The total tonnage 482, was sold to Orange Grove Estate and the revenue obtained was \$1,331.27. Owing to the drought, some plant canes (2 acres) were cut down and used for fodder: twelve acres were planted during the year of which half will be reaped in the 1935 crop.

Uba Cane.

44. The Uba, like the seedling canes, suffered from the drought and the yield was very light in most fields: it came in quite useful for fodder before and after crop, but as most of it was used early in the year, there was not sufficient to supply the stock after the first week in June.

Fodder Plants.

45. There was a general shortage in all the grass fields; the Elephant grass has now completely died out, and that, together with the dry weather, has accounted for the crop in tonnage. It was impossible to supply the Constabulary horses for 5 months and the revenue derived was \$1,443.25 as compared with \$2,404.32 in 1933.

Coconuts.

46. Several trees died owing to the drought and the yield was much smaller than in former years. A large number of rejected nuts were fed to the pigs and \$249.94 was realised for nuts sold.

Visits, Educational Work, Meetings, &c.

47. The following were among the visitors to the Farm during the year: Sir Alan Pim; Sir James Currie; Major the Hon. Edward Lascelles and Lady Jean Lascelles; the Venezuelan Consul and party; the Government Veterinary Officers of Curacao and Surinam; the Hon. T. M. Kelshall; the Principal and Students of the Imperial College of Tropical Agriculture.

48. The teachers from the Government Training College; the members of the Fyzabad District, Agricultural Society, as well as the schoolchildren from the Belmont Intermediate School, the Mucurapo R.C. the R. C. and Wesleyan Sunday School from the Naparimas paid educational visits to the Farm.

49. The Public Works Department did not carry out any Extraordinary works during the year, but they did general repairs to several buildings.

REVENUE.				EXPENDITURE.			
	£	s.	d.		£	s.	d.
Sale of Stock	1,105	8	9½	Personal Emoluments	715	0	0
Sale of Canes	277	6	11½	Maintenance	2,404	19	9½
Sale of Milk and Eggs	3,771	7	5½	Gatekeeper, Trinidad Government			
Stud Fees	155	14	2	Railway	25	0	0
Pasturage and Stabling	300	13	6½	Travelling	13	5	0
Miscellaneous	454	6	1	Motor Lorry Expenses	239	11	0½
				Expenses of Annual Sale	24	19	3½
	6,065	1	0	Grass Land Experiments	29	18	11½
				Materials	299	14	2½
				Stock—Purchase	554	6	11
				Feed Purchase	1,499	16	2½
				Expenses of Stallions	149	18	4
					5,956	9	9

H. V. M. METIVIER,
Officer-in-Charge, Government Farm.

REPORT OF THE VETERINARY DIVISION—1934.**General.**

The livestock in the colony suffered a great deal owing to the severe drought, the rainfall being approximately half that of 1933: the pastures and grass fields remained in a parched condition until early in September.

2. The Government Veterinary Surgeon proceeded to Grenada on duty from 18th to 28th May, and in accordance with a request from the Acting Governor of the Windward Islands, through the Advisory Department of the Imperial College of Tropical Agriculture, he visited St. Lucia from the 13th to 23rd June to investigate an outbreak of disease in sheep and also to report generally on the livestock of the island.

3. Duty leave was also granted the Government Veterinary Surgeon to attend the 12th International Veterinary Conference in New York; the opportunity was taken to attend a short course in Parasitology at the Institute of Parasitology, McDonald College, Canada, and to visit the Packing Houses of Swifts in Chicago: this officer sailed for the United States of America and Canada on the 1st August and returned on 16th September.

4. During the absence of the Government Veterinary Surgeon on duty leave, Dr. J. L. Shannon, D.V.M., the Assistant Officer in Charge of the Government Farm, acted for him.

5. The Veterinary Officer formerly stationed in Tobago was again kept in Trinidad throughout the year for the vaccination campaign against paralytic rabies: he resided in the St. Joseph district, as most cases this year were in the northern part of the colony: this officer also assisted in the tuberculin testing of dairy cows in rural districts around the city of Port-of-Spain.

6. The Assistant Officer in Charge of the Government Stock Farm again assisted in this rabies vaccination work and received an allowance for this work.

7. The recommendations of the Committee appointed to report on the incidence of Paralytic Rabies, which were fully endorsed by the Colonial Advisory Council of Agriculture and Animal Health in London in 1933, were put into full force by the appointment of Professor Ulrich of the Imperial College of Tropical Agriculture to carry out the study of bats. Cages have been constructed at the Government Stock Farm in which both blood-sucking and fruit-eating bats are being kept under artificial conditions quite successfully. It will now be possible to carry out further experiments with these animals under laboratory conditions.

8. A small Committee consisting of the Surgeon General (Chairman), the Director of Agriculture, the Government Bacteriologist, and the Government Veterinary Surgeon, with the Deputy Surgeon General as Secretary, was appointed to arrange the programme of the bat work with Professor Ulrich: this Committee held three meetings during the year.

9. There were two meetings of the Animal Husbandry Committee of the Agricultural Society during the year. The Society's branding irons have now been registered, and the dairy cattle on the Waterloo Group of Estates were inspected for registration. The Government Veterinary Surgeon submitted an estimate—cost and expenditure—for a Livestock Exhibition which it was proposed should be held in 1935 at one of the meetings.

10. No meetings of the Veterinary Surgeons' Registration Board were held during the year, as there were no applications to the Secretary for registration.

11. The Government Veterinary Surgeon attended all the meetings (6) of the Board of Agriculture during the year, and submitted reports on Paralytic Rabies for the Board's information: these reports were published in the daily papers and printed in the minutes of the meetings.

12. Lectures were given to the Naparima and Chaguanas District Agricultural Societies at San Fernando and Chaguanas, respectively.

Proclaimed Diseases.

Anthrax.

13. There were no outbreaks of this disease during the year: specimens were received from 2 suspected sporadic cases, but they were both negative. One hundred and sixteen head of cattle that were removed from the Quarantine Station were vaccinated against the disease before they were taken away.

Swine Fever.

14. Two reports of suspected cases of Swine Fever were made during the year, one from Caura and the other from Tacarigua, but in both cases deaths were due to other causes—enteritis following irritants in the food.

Tuberculosis.

15. Five head of cattle sold by an Estate to the butcher were found infected at the abattoir, and the whole herd of the Estate was tested by their Veterinary Officer and ten were positive. There were 12 cases in cattle imported from British Guiana at the Detention Station. Three head of cattle (2 bulls and 1 cow) were detained at the Port of Entry and tested with tuberculin, but they were all negative. In accordance with the requirements of the City Council of Port-of-Spain for the granting of licences for the sale of milk in the city 1,018 dairy cows and heifers in rural districts, belonging chiefly to peasants were tested, but there were only four doubtful reactors at the end of the year: these will be retested in 1935.

Glanders and Epizootic Lymphangitis.

16. There is still a tendency to confuse Ulcerative Lymphangitis with both these diseases, of which no cases occurred.

Rabies.

17. A suspected case was reported in an Alsatian dog, but the animal was placed under observation and proved to be negative. Twenty-two dogs (14 United States of America, 3 Venezuela, 2 British Guiana, 1 Brazil, 1 France, 1 St. Thomas) were imported from countries other than Great Britain and Northern Ireland during the year and were quarantined at the Government Quarantine Station for the first three months and at their owners' residence for the last three months. One dog died at its owner's residence from Distemper.

18. No feline animals were quarantined during the year: there were 3 cats imported during the year, but they were all from Great Britain.

Foot and Mouth Disease.

19. A permit was granted in one case to import a British Alpine doe (goat) from England: the animal did not pass through the Port of London, but was segregated at its owner's residence for one month on arrival. No other cloven footed animals were imported from countries where Foot and Mouth Disease is enzootic. All steamers arriving (Prince and Munsoon Lines) from South America with frozen meat—Argentina, Uruguay and Brazil—were boarded and the Veterinary Certificates accompanying the meat examined before the meat was allowed to land.

Paralytic Rabies.

20. The number of cases of Paralytic Rabies reported during the year—312—was approximately the same as in 1933, but it is believed that more accurate records of cases were kept, due to a larger Field Staff, and that vaccination helped considerably to reduce the number of cases. No further report was received from the Director of Research—Dr. W. H. Andrews—Veterinary Laboratory of the Ministry of Agriculture and Fisheries, England, during the year, but the Government Veterinary Surgeon had an opportunity of discussing the control of this disease, during the International Veterinary Conference in New York, with Dr. Andrews, as well as with representatives of the Argentine, Brazil, &c., where the disease is well known. In Brazil, the Argentine, Uruguay, &c., the best results have been obtained by vaccination, but they have been using double the dose given here, and with better results: the virus is usually, as in this colony, made with the fixed virus and is a 33½ per cent. emulsion in carbolic saline. It is intended to inoculate larger doses in 1935 or to vaccinate more frequently—twice a year—using the smaller dose. Brazil has now confirmed the findings in this colony that the bat is the vector of the disease and a report to this effect has been received from that Government. A subsidiary method of control of this disease, namely, the poisoning of bats by treating their biting sites on animals with strychnine, has been used with success.

Non-proclaimed Diseases.

Tetanus.

21. A few more cases were seen, as owners of stock confused this disease again with Paralytic Rabies.

Strangles and Influenza.

22. These conditions were chiefly observed in newly imported equidae, chiefly mules from the U.S.A. but it was usually Strangles of the benign nature that was seen and there was no tendency to Metastasis as in 1933.

Parasitic Gastritis.

23. Owing to the extremely dry weather up to the end of August, lambs and calves suffered little from parasites and the deaths from this cause were negligible.

Pneumonia in Calves.

24. This condition was again responsible for a heavy death rate in pure bred and high grade calves in the large dairies: the use of wooden lathed flooring in pens together with the removal of calves into more protected enclosures during the very cold months early in the year, has checked the death rate.

Dermatitis in Horsekind.

25. This form of skin irritation which is very prevalent, in horses especially, during rainy years, was seldom seen during the year, and the cases were of a milder kind and yielded to treatment readily.

Ulcerative Lymphangitis.

26. Cases were again seen on some of the Sugar Estates or in mules cast and sold by them to peasants: some of the estates are now destroying the cases of old standing.

Bovine Piroplasmosis.

27. There were no outbreaks of this disease and very few sporadic cases have occurred in the dairies, as no cattle were imported during the year from temperate climates.

Contagious Abortion in Cattle.

28. A small outbreak occurred in a dairy in Tobago following the importation of 6 dairy cows and heifers from Barbados. A few cases were also seen in dairies in Trinidad and in all cases owners were advised to carry out quarantine methods rather than to use either (a) dead vaccine which is useless, or (b) living vaccine that is dangerous and still in the experimental stage.

Ophthalmia.

29. This disease, which occurs chiefly in large dairies and affects calves especially, was again very prevalent on the Government Farm. It was at one time believed that lice, which attack the eye-lashes, were the cause of this condition; the irritation they cause, leading to the animal rubbing its eyes and developing Keratitis and Corneal ulcers, which sometimes burst causing collapse of the whole eye. Lice do not seem to play any part in this trouble, as in the peasants' cattle, especially calves, there is a heavy infection of lice in their eye-lashes. It would appear that this condition, like similar ones reported in England and elsewhere, is probably due to a virus and that flies play an important part in spreading the disease—and overcrowding and filthy pens are predisposing factors.

Importation of Animals.

30. The following animals were imported into the colony during the year and inspected:

Cattle, including 7,557 from Venezuela, 523 from British Guiana and 1 Holstein Friesian	8,116
Bull from the Carnation Farms	110
Horses, including 14 thoroughbreds from England and 8 Kentucky Saddle Horses ..	186
Mules, including 82 mules from U. S. A.	75
Donkeys, including 1 Missouri Jack Donkey	64
Dogs, including 6 Grey Hounds from England and 14 American hounds	4,259
Pigs, including 351 from British Guiana	1,272
Sheep	3,833
Goats, including 30 from Barbados and 1 British Alpine from the United Kingdom	3
Domestic Cats	

Quarantine Station.

31. The following animals were admitted to the Quarantine Station during the year:

Cattle	8,086
Horses	7
Mules	48
Donkeys	2
Dogs	23
Pigs	43 ¹
Sheep	10
Goats	4 ¹

There were nine head of cattle slaughtered on arrival at the Station due to injuries (emergency slaughter): 116 cattle were vaccinated against Anthrax before leaving the Station, and 3 tuberculin tested. Twenty-one deaths occurred—11 animals were trampled in the punts, 8 died from exhaustion and collapse, 1 from tuberculosis and 1 due to haemorrhage of the lungs—during the year.

32. The revenue received by Government for the services of the Government Veterinary Surgeon for inspection of animals and for the supervision of the Quarantine Station amounted to £1,507 7s. od.

33. Owing to the Paralytic Rabies investigation and its control (vaccination) it was necessary for extra expenditure to be allocated as follows:—

	£	s.	d.
1. Bat Investigation Campaign	790	17	10
2. Allowance for assistance	250	0	0
3. Preparation of vaccine	578	12	1

The amount collected for the sale of vaccine was £309 0s. od.

H. V. M. METIVIER,
Government Veterinary Surgeon.

16th April, 1935.

REPORT OF THE MANAGER, ST. AUGUSTINE NURSERY.

Plant Distribution.

Plants distributed in 1934 were 86,260 as compared with 92,719 in 1933.

2. Revenue for all plants and other products was £1,715 19s. od. as compared with £1,374 17s. 0½d. in 1933, an increase of £341 1s. 11½d. This was due to the price of grapefruit plants being raised from 12 cents to 25 cents each.

3. A detailed list of plants, seeds, cuttings, &c., distributed is given below:—

CITRUS BUDDED:

Grapefruit (Marsh)	..	..	..	..	10,513	
Do. (Assorted)	..	..	..	..	440	10,953
Oranges	..	..	..	..		4,289
T.I Limes	..	..	..	..		5,006
						20,248

OTHER FRUIT:

Mangoes (grafted)	..	..	..	..	1,984	
Avocados (budded and grafted)	..	..	..	..	843	2,827
Limes, West Indian seedlings	..	..	..	..		39,318
Miscellaneous seedlings	..	..	..	..		994
Cocoa:—Seedlings	..	..	..	..		14,244
TIMBER TREES	..	..	..	..		1,758
OTHER ECONOMIC PLANTS	..	..	..	..		482
DECORATIVE PLANTS	..	..	..	..		6,389
Total No. of plants distributed	..	..	..	..		86,260

BUDWOOD (No. of Buds)

T.I limes	..	..	..	..	10,025	
Other Citrus	..	..	..	..	30,047	40,072

CUTTINGS

..	..	..	..	..	..	1,428
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SEEDS:

Countable	..	..	..	..	..	8,052
Miscellaneous	..	..	..	..	293 pkts. and 30 lbs.	

PRODUCE:

Fruits, Miscellaneous	..	..	..	..	1,340 and 7,787 lbs.	
Vegetables, Miscellaneous	..	..	..	..	2,434 lbs.	

PREPARED TAPE

..	..	..	..	..	..	2,867 yds.
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Citrus.

4. Orders for grapefruit and orange plants were supplied in full, this being the first time since 1931 when the planting of grapefruit commenced in large numbers, that the St. Augustine Nursery has been able to supply orders in full.

5. Owing to a very late rainy season the lifting of citrus from the open ground did not commence until August 13th and even then greater care than usual had to be taken with lifting balled plants owing to the abnormally low rainfall.

6. The total amount of all budded citrus distributed for the year was 20,248 as compared with 27,566 in 1933.

7. There is a growing demand for budwood and budded plants of T.I limes and 5,006 plants were distributed as compared with 1,204 for the previous year.

8. Of the sum of £1,562 specially voted to increase the output of grapefruit plants, £743 1s. 7d. was spent in 1934, £50 being spent on metalling a road to enable the plants to be taken delivery of by truck. Stock of citrus remaining on hand and suitable for delivery in 1935 raised by means of this fund is as follows:—

Grapefruit	..	..	..	..	..	11,155
Other citrus	..	..	..	..	..	2,337
T.I limes	..	..	..	..	..	659
Total	..	..	..	..	..	14,151

Sour Orange Stock.

9. Scab (*Cladosporium citri*) has been less severe on the sour orange stocks this year apparently due to the particularly dry weather. The rainfall returns for the adjacent Government Farm shows that it was about 50 per cent. less than for 1933.

January to December, 1933 88.47 inches.

January to December, 1934 47.02 inches.

10. The method described in my 1933 report of sowing seeds thinly in well prepared beds under shade in January and February and transplanting early in June is still being followed as it is found to be the best means of controlling scab in the young seedlings.

Limes.

11. The demand for plants of the West Indian seedlings lime could not be met in full, 39,318 were distributed in 1934 as against 34,278 in 1933.

12. The growing of the West Indian seedling lime under shelter has been found to control withertip and this method is in practice here, from the sowing of the seed to the planting out for lifting by bare root. Shelters roofed with glass substitutes are in use for the purpose.

Cocoa.

13. The distribution of cocoa seedlings has steadily fallen from 72,321 in the peak year of 1929 to 14,244 in 1934.

Mangoes.

14. Grafted varieties, mostly Julie, distributed were 1,332 in 1933 and 1,984 in 1934.

Avocados.

15. Named budded varieties were less in demand than in 1933 only 843 being distributed as against 1,275 in 1933.

Orchard Plots planted for propagating material in 1931.*Avocados.*

16. The varieties Pollock, Rudder, St. Ann's, River, and St. Clair have fruited. The trees suffered severely from the dry weather and were late in making new growth, consequently buds for propagating were scarce.

Mangoes.

17. Both the Jamaica Bombay mango and the Trinidad Peters variety in the Mango plot fruited this year, the growth, habit, foliage and fruit are similar and they are recognized as one variety.

T.1 Limes.

18. Yield of T.1 hybrid from the half acre block planted at St. Augustine, July to September, 1929, is given in the following table for the years 1933 and 1934. The number of fruit reaped were about 500 more than in the previous year but due to the severe dry weather the fruit were smaller and there was a decrease in weight.

<i>Months.</i>					1933.	1934.
					<i>lbs.</i>	<i>lbs.</i>
January	..	..	..	..	1,165	1,320
February	..	..	..	..	1,015	875
March	..	..	..	..	1,818	1,276
April	..	..	..	..	1,002	537
May	..	..	..	..	486	319
June	..	..	..	..	1,792	1,209
July	..	..	..	..	1,046	724
August	..	..	..	..	876	426
September	..	..	..	..	62	201
October	..	..	..	..	638	162
November	..	..	..	..	184	726
December	..	..	..	..	135	464
Total	..	..	..	..	10,219	8,239

In barrels of 160 lbs. per acre this is equivalent to :

<i>Year.</i>					<i>Barrels.</i>
1933	..	..	..	..	127.72
1934	..	..	..	..	102.98

General.*Tung Oil.*

19. The row of trees of *Aleurites montana* planted in 1931 have flowered again but carried no fruit.

Oil Palm.

20. Plants grown from a consignment of seeds received from Nigeria in 1933 have been planted in the Royal Botanic Gardens, and at Non Pareil Estate, Sangre Grande.

Tonca Bean.

21. Trials of budding have been continued and it is now regarded as a practical measure to propagate this crop by the patch bud method. One estate has worked over a number of trees four to five years old with material from selected trees at River Estate.

Avocados.

22. A trial was made to test if large avocado plants would safely lift from the open ground for transport by the method which is similar to that in practice with citrus. Plants budded in bamboo pots were transplanted in the open ground where they made much larger and stronger growth than those left in the bamboo pots. The plants moved exceedingly well, the larger size being appreciated by the public.

Papaw.

23. The three varieties, Porto Rico, Mexico and Seychelles mentioned in my report last year have been established in separate fields and appear to be growing true to type. They are of a low bearing habit. Owing to the rains commencing late they could not be planted out before September.

Tomatoes.

24. Trials were made of the following tomato varieties: Red Plum, Red Pear, Red Cherrie, Peach, Currant, Yellow Plum, Yellow Pear, Yellow Cherrie, King Humbert. Pickings of the Yellow and Red Plum were recorded. *Red Plum* on an area of 38 ft. x 100 ft.=799 plants yielded 1,700 lb. or 2.12 lb. per plant. *Yellow Plum* on an area of 42 ft. x 120 ft.=954 plants yielded 1,901 lb. or 1.99 lb. per plant.

25. No records were taken of the other varieties their chief use being for decorative purposes.

Tephrosia Vogelii (Fish Bean).

26. *Tephrosia Vogelii* (Fish Bean), which was introduced in April from the Director of Agriculture, Zomba, Nyasaland, has grown well and seeds freely.

Budwood of Pineapple Orange.

27. Budwood of Pineapple orange No. C.P. 12216 from a special tree in the large Orange house, Department of Agriculture, Washington, U.S.A., was received in November, 1933, and successfully propagated, plots of 16 trees being established at the St. Augustine Experiment Station and 5 trees at River Estate.

Experimental Shipment of Budwood.

28. A further consignment of budwood was sent to Nigeria *via* Liverpool packed in thermos flasks which were carried in a cool room. A report received as to its condition on arrival is given below :—

- (1) "Marsh seedless flasks, budwood arrived in excellent condition with no dead sticks.
- (2) Foster flask, budwood arrived in very fair condition, three sticks had died.
- (3) Lue Gim Gong flask, budwood arrived in fair condition only five sticks contained some apparently viable buds.
- (4) Parson Brown and Valencia flasks, in both instances all budded arrived dead. It is interesting to note that on both occasions two flasks have arrived without viable buds. This suggests that in similar circumstances some flasks may be expected to come through with live budwood."

Visits of Societies.

29. Visits were made by the Fyzabad District Agricultural Society, The Horticultural Club, C.M.I. School, Rock-Penal Road; Chaguaramas District Agricultural Society and the Diego Martin District Agricultural Society.

Donors.

Abroad :—Departments of Agriculture, South Africa, Ceylon, Nyasaland, New Zealand, St. Vincent, Grenada, Curator, Royal Botanic Gardens, Kew; J. E. Higgins, Canal, Zone, Panama; The Director, Imperial Institute, London; Otto Katzenstein & Co., Atalantia, Porto Rico; Professor Juan Balme, Mexico; Howard University, Cuba; Mr. Finch, Venezuela.

Local :—Commissioner of Agriculture, Imperial College of Tropical Agriculture; Mr. J. B. L. Todd, and Mr. C. Brown.

F. C. BUTHN,
Manager of Nursery.

15th April, 1935.

REPORT OF THE MANAGER, ST. AUGUSTINE EXPERIMENTAL STATION.

Rainfall.

The year 1934 was one of exceptional drought, the total rainfall being 47.02 inches as compared with 88.47 inches in 1933, and 55.30 inches average over a nineteen year period.

2. The dry season extended into the middle of July and delayed the planting of crops by over two months.

3. Rainfall as recorded at the adjacent Government Farm is given.

Rainfall, 1934.

January	..	..	1.31 ins.	July	..	..	3.27 ins.
February	..	..	1.07 "	August	..	..	7.42 "
March	..	..	0.60 "	September	..	..	6.11 "
April	..	..	0.07 "	October	..	..	10.09 "
May	..	..	0.93 "	November	..	..	11.83 "
June	..	..	0.90 "	December	..	..	3.42 "
							<i>Total</i> .. 47.02 inches.

Citrus Experimental Block.

Introduction.

4. The Citrus experimental block covers an area of nearly 45 acres and is conducted in accordance with the programme outlined in the *Annual Report of the Economic Botanist* for 1931, p. 24, and in *Tropical Agriculture* Vol. IX. No. 10, pp. 301-306, 1932. The experiments comprise manurial and cultivation trials and investigations as regards stocks and methods of propagation in relation to gummosis.

5. In general, the trees have developed well, except for the controls and unmanured plots. Certain trees which were not available in 1932 were planted in their respective positions and one tree which had died was replaced. Twenty-five trees in all experiments remain to be planted.

6. Each plot in the cultural and manurial experiments has been labelled to show the treatment it receives.

Care of Experiments.

7. *Cultivation*.—This was continued on the lines drawn up in the original programme. An attempt is being made to check Para grass by weeding and stacking in heaps in the field. In the experiments confined to cultural methods and in which no manures are applied growth is very noticeably backward as compared with any of the other experiments. During the latter part of the year they made better growth. An area used as a demonstration for cutlassing alone versus tillage and manurial treatment shows a marked difference in favour of the treated plot.

8. *Application of Fertilizer*.—Except for the manurial and cultural experiments where specific treatments are laid down the general manurial treatment is to apply to each tree $\frac{1}{2}$ lb. Sulphate of Ammonia, $\frac{1}{2}$ lb. Sulphate of Potash, 1 lb. Superphosphate and 50 lb. Pen manure multiplied by each year of the tree's age. This is divided in three parts and applied during the months of May, August and November. It has given good results.

9. *Pruning*.—Careful attention to pruning was carried out as necessary principally with the idea of shaping the young trees.

10. *Windbreaks*.—The windbreak in the manurial experiment and demonstration block was cut down during August. It should have been cut earlier, but the continued drought made it rather unsafe to expose the trees to strong drying winds. Some of the trees were beginning to show signs of the effect of the wind-break on their shape.

11. *Pests and Diseases*.—Only three trees have shown definite signs of Gummosis, one has died and the other two are showing signs of recovery.

12. Scale insects have been a continuous trouble throughout the year. A regular spraying programme was carried out during the dry season and part of the wet season and the insects were kept more or less under control with "Citromulsion."

13. Rust mite was severe, spoiling a good many of the first fruits.

14. Minor pests have been Parasol Ants, Stinging Ants, Weevils, Mealy bugs and small snails.

15. A condition of splitting of the bark and subsequent gumming and drying of the branches was noticed in the cultural experiment. The cause has not been discovered.

16. *Crop*.—Many of the trees commenced to bear but, as is usual with young trees, the fruit were inclined to be coarse.

17. *Growth Measurements*.—Measurements of girth below and above the bud union, of spread in two directions and of height were taken in January and July. The actual field work was somewhat speeded up by the use of improved scales and measuring rods. The measurement of diameter of the trunk of the trees was abandoned in favour of girth, this latter measurement being less liable to field errors. The necessary conversions were made in the previous records.

Grapefruit and Oranges (Two-acre block planted 1923).

18. The trees in this block have suffered considerably from gummosis; 24 trees which died were dug out during the year.

19. The whole field was drained, weeded and cutlassed and supplies were planted during August and September as follows:—

4 Duncan
9 Foster.
10 Marsh.
12 Walters.
3 Valencia
12 Parson Brown.
11 Jaffa.
2 Navel.

Cost of Citrus Experiments during 1934.

20. The following table shows the total cost and on an acreage basis for all the citrus experiments at St. Augustine.

No.	Experiment.					Total Cost.	Cost per acre.
						\$ c.	\$ c.
1	Stocks for grapefruit	..	..	..	..	265.40	66.35
2	Comparison of stocks	..	..	..	..	160.49	76.42
3	Height bud insertion, grapefruit	..	..	..	..	69.58	69.58
4	Root selection	..	..	..	..	21.88	62.51
7	Stocks for oranges						
	Block I	..	..	..	..	69.20	76.05
	Block II	..	..	..	..	66.89	73.50
	Block III	..	..	..	..	65.09	71.53
8	Height bud insertion, oranges	..	..	..	..	53.03	75.75
9	Demonstration						
	A. 113	..	..	..	..	14.14	24.38
	B. 114	..	..	..	..	38.20	65.86
	Guard Rows						
	Experiment I	..	..	..	..	33.92	67.84
	Do. II	..	..	..	..	16.37	81.85
	Do. III	..	..	..	..	20.39	67.96
	Do. V	..	..	..	..	16.46	65.84
	Do. VI	..	..	..	..	770.98	64.25
	Do. VII	..	..	..	..	81.63	58.30
	Do. IX	..	..	..	..	17.09	51.79
5	Cultural						
	Plots IA	..	..	..	..	22.35	29.80
	IB	..	..	..	..	29.69	39.58
	IIA	..	..	..	..	25.62	34.16
	IIB	..	..	..	..	46.16	61.54
	I IA	..	..	..	..	45.46	60.61
	IIIB	..	..	..	..	38.83	51.77
	IVA	..	..	..	..	36.08	48.11
	IVB	..	..	..	..	32.90	43.87
6	Manurial						
	Plot: IA	..	..	..	..	33.19	44.25
	IB	..	..	..	..	36.38	48.50
	IC	..	..	..	..	37.76	50.35
	ID	..	..	..	..	38.91	51.88
	IIA	..	..	..	..	36.90	49.20
	IIB	..	..	..	..	37.39	49.85
	IIC	..	..	..	..	38.84	51.78
	IID	..	..	..	..	39.95	53.27
	IIIA	..	..	..	..	36.67	48.89
	IIIB	..	..	..	..	39.24	52.32
	IIIC	..	..	..	..	38.72	51.62
	IIID	..	..	..	..	41.18	54.91
	IVA	..	..	..	..	45.10	60.13
	IVB	..	..	..	..	46.44	61.92
	IVC	..	..	..	..	44.92	59.89
	IVD	..	..	..	..	48.74	65.00

Sugar Cane.

21. The sugar cane crop for 1934 was very low, most of the remaining fields were to be turned into other cultivation and very little work was done on Fields 16, 17 and 18.

22. The total crop reaped was 186 tons 12 cwts. 1 qr., and was sent to Orange Grove Factory.

23. Fields 16, 17 and 18 were stumped, cleared and planted in other crops, only $4\frac{1}{2}$ acres of cane in Field 19 being left to crop in 1935. It is intended to reserve the whole of Field 19 (9.29 acres) for cane work, chiefly for the purpose of multiplication of new varieties.

24. During December, 16 of the most promising Trinidad seedlings were planted in Field 19 in small observation blocks 50 ft. by 22 ft. The collection of 67 varieties was replanted in Field 19 in small two row plots of twelve cane stools each. Small plots of Diamond 10 and Mayaguez 28 were planted for multiplication, in April and June, respectively.

25. Tests of single versus double-eyed plants of M. 28 have shown practically as good results with single as with double-eyed plants, if treated as nursery plots and given frequent care. This is an important point in quick multiplication of new varieties.

Minor Crops.

26. *Pigeon Peas*.—Two beds of Trinidad Selected Pigeon Peas were sown in August. These will be reselected during February, 1935.

27. The aim in selection is to establish a pigeon pea of good growth, heavy bearing, evenness of ripening and as free from variation as possible. After about eight years selection a pea having most of these characteristics has been established.

28. There is a fair local demand for this pea for seed.

Description :

Medium to tall plant. 5-8 ft. in height.

Green

Pod :—colour green streaked with dark purple ; size 2.5-3.0 in. x 0.5 in.

Peas :—large, bright green suitable for market.

Dried

Pod :—colour dull brown ; fair size.

Peas :—large, very pale brown, suitable for market.

29. A description of a few remaining varieties planted in Field 15 is given and their possibilities for the local market.

Hawaiian Red.

Introduced in 1925.

Tall plant 6-10 ft. in height.

Green

Pod :—light green ; rather small size 2.0 in. x 0.5 in.

Peas :—pale green ; fair size ; suitable for market.

Dried

Pod :—dark brown in colour ; rather small.

Peas :—light burnt brown in colour ; rather small ; not suitable for market.

Hawaiian White.

Introduced and mixed with Hawaiian Red.

Tall plant, 6-10 ft. in height.

Green

Pod :—light green ; fairly small, 2.0 x 0.5 in.

Peas :—pale green ; fair size ; suitable for market.

Dried

Pod :—dull brown in colour ; small.

Peas :—pale cinnamon in colour ; small ; might pass for market.

Negros.

Introduced from Porto Rico in 1929.

Tall plant.

Green

Pod :—dark purple brown in colour ; small and thin, size 1.0-1.5 in. x 0.5 in.

Peas :—bright purple brown ; small ; unsuitable for market.

Dried

Pod :—pinkish-purple in colour ; small.

Peas :—dull dark purple ; very small ; unsuitable for market.

Americanos.

Introduced from Porto Rico in 1929.

Tall plant.

Green

Pod :—pale green with pinkish tinge ; fair size 2.0-2.5 in. x 0.5 in.

Peas :—bright green in colour ; fair size ; might suit the market.

Dried

Pod :—dull blackish-brown in colour ; fair size ; poor appearance.

Peas :—light brown in colour ; small ; rather too dark for market.

Cadiz.

Introduced from Porto Rico in 1929.

Green

Pod :—colour, black with a green tinge ; rather small and thin ; size 2.0-2.5 in. x 0.25-0.5 in.

Peas :—Fair size, poor appearance, probably not suitable for market.

Dried

Pod :—dull blackish-brown ; rather small.

Peas :—pale buff ; small ; not suitable for market.

4448.

Introduced from Porto Rico in 1929.

Green

Pod :—greenish-brown in colour ; small, thin and short ; size 1.0-1.5 in. x 0.25 in.

Peas :—pale green ; very small ; not suitable for market.

Dried

Pod :—light brownish-black ; very small.

Peas :—pale brown ; very small ; unsuitable for market.

Dwarf Pigeon Peas.

Short plant, 3-4 ft. in height.

Green

Pod :—dull purple brown, streaked with green ; rather small ; size 1.5 in. x 0.25-0.5 in.

Peas :—pale green ; rather small ; unsuitable for market.

Dried

Pod :—dull grey-brown in colour ; small.

Peas :—light brown in colour ; very small ; too small and dark for market.

Asceibenos.

Introduced from Porto Rico in 1929.

A tall plant.

Green

Pod :—bright green in colour ; fair size, 2.0-2.5 in. x 0.5 in.

Peas :—bright green in colour ; full and good size, suitable for market.

Dried

Pod :—light greyish-brown in colour.

Peas :—pale coffee brown ; fair size ; suitable for market.

30. Other introductions have failed or crossed and are not true to the type of the original varieties.

31. *Cassava*.—The following varieties are being grown and kept for stock :

Bitter Cassava.—Sellier ; Parasol ; Turkey Claw ; Mama l'enfant.

Sweet Cassava.—White Stick ; Black Stick.

32. Small samples have been sent to Nigeria and Tanganyika Territory. The local demand for varieties is practically negligible.

Legumes.

33. *Commercial Beans*.—Several kinds of commercial beans introduced through the Imperial Institute were tried. Three small plots of Madagascar bean, Ohtenashi bean and Seven year bean, planted in Field 16 in September were a failure. Seven year bean germinated badly and died out. Ohtenashi bean set seed, but the plants died before the seed was ripe. Madagascar bean failed to set seed, although staked.

34. *Cover Crops*.—Part of Field 17 was planted in a collection of cover crops during August, for the purpose of raising a supply of seed for distribution and for testing their suitability for various cultural purposes.

35. Under the conditions pertaining at St. Augustine, the following may be recommended for the particular purposes under which they are tested :—

WINDBREAKS.

Perennial :—*Tephrosia candida*. Lasts about 2 years, reaching a height of 10-15 ft. Germinates well, but must be sown 5-6 months before the crop which it is to protect.

Annual :—*Crotalaria usaramoensis* and *Crotalaria anagyroides* could be used. Height 6-8 ft. A thick mass of vegetation. Lasts 5-6 months.

COVER CROPS.

Semi-permanent :—*Calopogonium mucunoides*. A creeping cover crop about 2 ft. high. Medium, quick growth and reseeds well.

Annual :—

Tall—*C. usaramoensis*, *C. anagyroides*, and *Desmodium gyroides*. Last 5-7 months. *C. juncea* very vigorous, only lasts for 2 months.

Short—*C. vasculosa* and *C. valetonii*. About 2-4 ft. in height. Thick, strong growing cover. Should have distinct possibilities for citrus cultivation.

Creeping—*Pueraria javanica*, *Centrosema plumerii* and *Centrosema pubescens*. A thick mass of vines about 1-2 ft. in height. Lasts 4-5 months. *Phaseolus mungo* or Woolly pyrol and Jerusalem pea are quick growing cover crops lasting 2-3 months.

GREEN MANURES.

C. anagyroides and *C. usaramoensis* turn in at 3-4 months old.

C. juncea turns in at 6 weeks old.

Canavalia plagiisperma should do well for a heavy green manure crop. Turns in at 4-5 months old.

36. *Banana Varieties Collection*.—A collection of most of the local varieties and some imported varieties are being kept. These include :—ANANICA, CONGO, I.C.T.A. CANARY, GIANT GOVERNOR, GIANT DEMERARA, GIANT MORUGA, BURMA, SILK FIG, CLIKUITO, GROS JEAN, FIG BANDIA, MOKO, RED FIG.

37. *Fodder*.—In order to have a sufficient supply of fodder for the oxen during the dry season, Field 20 which had been abandoned, was prepared and planted with Uba, Guinea Grass and Guatemala grass in September.

38. The Uba showed poor germination owing to continued drought but the guinea grass has made good growth. The Guatemala grass is very patchy.

Labour.

39. During the month of September and the beginning of October an extra gang of men was employed in forking certain fields and repairing traces.

40. An extra vote of \$240.00 was provided out of Government funds and was a small part of a Government scheme for unemployment relief.

41. The men were employed in cutlassing, forking, hoeing, roundridging and draining Fields 6, 18, 19 (part), and 20. Over 5,000 feet of traces were put in order.

42. Approximately 18 men were employed for 32 days at 40 cents per day each.

Variety Trials on Sugar Cane Estates.

43. A certain amount of my time was spent on varietal sugar cane trials on the principal sugar estates. Seven of these trials were reaped during the crop season of 1934, necessitating 13 visits.

Estate.				Field.		Ratoon.	No. of reapings.
Orange Grove ..	..	..	..	..	F.16 ..	.. 2nd ..	3
Woodford Lodge ..	..	..	..	..	23 Petersfield ..	.. 2nd ..	2
Waterloo ..	..	..	..	..	F.54 ..	.. 2nd ..	3
Brechin Castle..	..	..	..	..	31 Milton ..	.. 1st ..	2
Esperanza ..	..	..	..	..	45 P.G. ..	.. Plant ..	1
Orange Grove ..	..	..	..	..	16 Macoya ..	.. " ..	1
Waterloo ..	..	..	..	..	30 Exchange ..	.. " ..	1

44. A report on the results of these trials has been made separately.

(Sgd.) E. J. GREGORY,
Manager.

Revenue and Expenditure.

REVENUE, 1934.

Heads.				£ s. d.			\$ c.
Cane and Cane Plants ..	..	..	..	108	17	5	522.58
Grapefruit ..	..	..	..	20	16	1½	99.87
Oranges ..	..	..	..	8	1	11	38.86
Cassava and plants ..	..	..	..	2	6	0	11.04
Cover Crop seeds..	..	..	..	3	6	6½	15.97
Miscellaneous ..	..	..	..	2	17	9½	13.87
Total ..	..	..	..	146	5	9½	702.19

EXPENDITURE, 1934.

Heads.				Expenditure.			Savings.			Total Vote.		
				£ s. d.			£ s. d.			£ s. d.		
Personal Emoluments :—Manager ..	..	..	..	400	0	0	..	..	..	400	0	0
Field Assistants ..	..	..	..	240	16	8	..	..	..	240	16	8
Other Charges :—Maintenance and Materials ..	..	..	..	440	1	6	1	10	..	440	3	4
Cultivation, Cane and other Crops ..	..	..	..	1,100	0	0	..	..	..	1,100	0	0
Stock ..	..	..	..	124	19	7½	4½	..	..	125	0	0
Total..	..	..	..	2,305	17	9½	2	2½	..	2,306	0	0

. REPORT OF CURATOR, ROYAL BOTANIC GARDENS.

Royal Botanic Gardens, Government House, St. Clair, Queen's Park, St. Ann's Mendez Savannahs and Red House.

Royal Botanic Gardens.

General.

The general condition of the gardens was maintained, although difficulty was experienced during the dry weather with watering. Attacks of chinch bug and mole crickets were severe and several lawns had to be replanted.

Flower Garden.

2. New introductions of annuals were planted out in the large beds in the flower garden area; *Gomphrena aurantiaca* and *Sutera grandiflora* proved very suitable for long flowering periods.

3. *Phlox*.—During the dry season ten beds in the main walk planted with *Phlox Drummondii* proved most effective for mass colour effects. Varieties used were :—Brilliant, Rosy chamois, Coccinea, Crimson Rose and white centre, Rosea oculata, Splendens vermilion red, Fimbriata and Cuspidata.

4. *Dahlias*.—Two hundred dahlias were imported from Messrs. Vilmorin-Andrieux during the beginning of the wet season. Beds along the main walk were planted up, separate varieties in each bed. Success was obtained with Emma Groot, Jonkheer van Tets, Dresselhuys, Katanga, Early Yellow, Jane-Cowl, Trentonian, Esmeralda, Rapallo, Menny Carlee, Couronne d'Or and Salmonea.

5. *Zinnia elegans* was well represented by several varieties during the latter part of the year.

6. Several kinds of *Alternanthera* were used as edgings for the flower beds.

7. *Poinsettias* used as low bedding plants made a brilliant display and were bordered by *Coleus Whittonii* and *Iresine*.

8. The display of *Gladiolus gavandensis* hybrids and *G. primulinus* deserve special mention. The following varieties were used:—War, Odin, Nancy Hanks, America, Apple Blossom, Baron Hulot, Venus, S hwaben, Baron Von Wynbergen, and mixed varieties of *G. primulinus*.

9. Groups of sunflowers (silver-leaved) *Helianthus argrophyllus* gave good results in the shrub border.

10. *Hibiscus* Dell.—The collections of standard *Hibiscus*, single and double varieties, have made fair growth, although many of the double varieties are extremely slow to form standards. The presence of roots of surrounding trees are troublesome especially in the crescent beds which have been manured three times during the year. The "rustic bridge" crossing the ravine was completed in March.

Exhibition.

11. A large display was arranged for the Field Naturalists Club's exhibition held from February 12th to 22nd. Groups of plants were arranged in their natural habitat as far as possible, e.g., "Native Orchids", "Insects camouflage", with foliage plants. There was also a group of native Cacti, in which was included plants grown by the late Mr. W. E. Broadway, M.B.E. A carpological exhibit was arranged from seeds collected from various sources.

12. At the Horticultural Club's annual flower show on April 8th and 9th, the exhibit "A Fantastic Garden" was arranged from plants and flowers from the Royal Botanic Gardens and from Mr. Geo. F. Huggins, O.B.E. The exhibit comprised a small miniature waterfall and running stream, rustic bridges, &c. Many exhibits of plants and flowers were staged at monthly meetings of the Club.

Flowers for the Royal Wedding.

13. At the suggestion of Mr. R. Warner a bouquet of native flowers was sent in ice for the wedding of their Royal Highnesses, the Duke and Duchess of Kent. The following flowers were used:—*Heliconia psittacorum*, wild ginger, *Palicourea crocea*, *Cephaelis tomentosa*, wild Ipecacuanha, *Warszewiczia coccinea*, Pride of Trinidad; foliage used consisted of *Lycopodium cernuum*, *Cyperus giganteus*, ferns and grasses.

14. Three hundred blooms of *Anthurium Andraeanum* (pink variety) were also sent. Thanks are due to many persons for their response in presenting the fine collection of blooms and to the Eden Fruit Shop for acting as a collecting Depot. The method of packing which proved successful was to place each layer of six or more blooms between sheets of tissue paper in wooden crates for taking on board. Treatment on board was to place the flowers in large containers with water; fresh water was given daily, and the stems were cut back every other day. They were reported to have arrived in good condition.

Government House.

15. The gardens surrounding His Excellency, the Governor's Residence have been well maintained with a continuous display of flowers throughout the year; the lawns suffered a great deal during the year but this has been remedied by re-turfing parts where the crickets did much damage.

16. A new hedge formed of a single row of *Murraya exotica* has been planted to replace the *Baleria cristata* in the Lady Chancellor Garden. Old shrubs were removed and other plants of a more attractive nature were planted; of special mention are *Bougainvillea* (Mrs. Helen McLean) and *Ixora rosea* (large pink flowering).

17. In Lady Byatt's Garden many useful plants and a collection of roses for cut flower purposes were grown. *Gloriosa superba* has flowered remarkably well and is a most useful plant for decorative work.

Vegetable Garden.

18. Vegetables of many kinds were grown in the garden and some new varieties were tried including Parsnips, Scorzonera and Mauritius peas with fair results.

St. Clair.

19. The surroundings of the buildings have been kept tidy.

Savannahs.

20. Quarterly inspections were made during the year and newly planted trees in the Queen's Park and St. Ann's Savannahs were attended to; these have made good growth. Additional trees of *Immortelles*, *Erythrina micropteryx*, were planted out near the old burial ground and near the old drinking trough.

21. Attention was also paid to trees in the grounds of the Red House, Queen's Royal College, Printing Office and St. Ann's Mental Hospital.

Red House.

22. The lawns suffered baldly during the year from attacks of mole crickets. The old *Eranthemum Eldorado* hedge was replaced by *Barleria cristata*.

23. I have to acknowledge many donations from abroad and from local sources of plants, seeds and orchids. Chief among those to whom the Department is indebted are:—

Abroad:—

Royal Botanic Gardens, Kew, Surrey, England.
Messrs. Vilmorin-Andrieux & Cie, France.
Botanic Gardens, Demerara, British Guiana.
The Coconut Grove Arboretum.
F. G. Walsingham, Esq., Cuba.
Captain Johnston.

Local:—

Geo F. Huggins, Esq., O.B.E.
Conservator of Forests.
Mrs. Helen McLean.
Mrs. R. Johnstone.

H. BRUINS-LICH,
Curator, Royal Botanic Gardens.

REPORT OF THE MANAGER, RIVER ESTATE.

Weather.

The year was characterized as a particularly dry one accompanied by high prevailing winds during the earlier months. The total rainfall registered was 66.04 inches as compared with 74.04 inches in 1933. Of this amount only 17.80 inches fell from January 1st to July 31st. The rains, however, from August to December 31st were fairly well distributed and there was no flooding.

Revenue and Expenditure.

2. All crops, except Tonca Bean, were good and in consequence revenue showed an increase of \$3,709.54 over that of 1933; the Tonca Bean Crop was generally short throughout the lower elevations of the island.

3. The total revenue for the year amounted to \$15,923.90 and the total expenditure to \$24,592.31. Revenue from crops and sources other than cacao amounted to \$4,152.35 an increase of \$1,447.66 as compared with the previous year's results and represents a record sum for revenue from such sources. With the continued development of Citrus, Tonca Bean and Coffee crops, still better results may be looked forward to within the next few years. Cacao prices were slightly better than those which obtained during 1933 and averaged 5½c. per lb. for 1st grade produce as against 4½c.

4. Non-recurrent expenditure on crops other than cacao, *e.g.*, timber plantations and experimental work accounted for a sum of \$7,161.69.

Area and its Utilisation.

5. River Estate although primarily a cacao plantation is also an experimental station of considerable importance and embraces the very large area of 1,629 acres of which approximately 1,238 acres are cultivated in various crops or otherwise occupied by buildings, curtilages, pastures, roads and grass-fields.

6. The standard of cultivation and road system developed and maintained throughout is much above that of the average plantation and includes a number of subsidiary crops such as Limes, Tonca Beans, Coffee, Grapefruit, Oranges and Mangoes. There are also very large timber plantations through which some 8 miles of bridle roads have been constructed during recent years, while the cacao section includes numerous and complicated experimental plots. These subsidiary crops which are still being extended are only now coming into moderate production and revenue from them is already considerable, being \$3,865.10 during 1934.

7. The planted areas and lands otherwise occupied may be set out approximately as follows:—

Cacao	..	..	..	452 acres (inclusive of new experimental plots not yet in bearing).
Limes	..	..	..	60 acres (20 acres in bearing).
Grapefruit and Oranges	..	..	..	30 acres (mostly in bearing).
Mangoes	..	..	..	6 acres (now coming into bearing).
Tonca Beans and Coffee	..	..	..	40 acres (interplanted except for 10 acres of Tonca Beans).
Roads, Traces, Grassfields, curtilages, pastures, &c.	..	..	..	50 acres.
Timber	..	..	..	600 acres
				1,238 acres

8. The total average cost of maintenance during the past 3 years of this 1,238 acres inclusive of all charges and capital expenditure such as purchase of contracts and advances to contractors, clearance of lands for new cultivations, construction of new roads and concrete bridges, all experimental work and, maintenance of timber plantations already taken over from contractors, the purchase of a new motor lorry, a working mule and payment of all salaries works out at only \$19.50 per acre per annum while the cost of supervision alone stands at less than \$4.50 per acre.

9. When due consideration is given to the amount and nature of the experiments conducted which includes the cutting out and replanting of fairly large areas of established cacao, the recording of individual yields during each picking of some 17,000 cacao trees and compilation of accumulated data, the number of various crops dealt with, the comparatively high standard of cultivation maintained, and general utility purposes of River Estate and the poor fertility of the soil as a whole, it is extremely doubtful whether there is in any part of the world a combined experimental station and mixed plantation of equal size and importance of which the cultivation and supervision costs are as low.

Labour.

10. River Estate plays an important part in the economic welfare of the district, particularly in days of stress such as these.

11. An average of over 150 men, women and boys, a number of whom are comfortably housed, are given regular employment throughout the year while there are 60 contractors planting timber on otherwise useless hill-lands, and limes, tonca beans and coffee on the lower and more accessible slopes, each thereby contributing his quota to the potential value of the property. These in their turn not only employ a limited amount of surplus labour in the process of working their "gardens" but produce and ensure an ample supply of provisions for the needs of their families and the local markets.

12. A great deal of work in the various cultivations such as outlassing of fields and timber plantations, digging and maintenance of roads, clearing of land for new cultivations, sawing of lumber, &c. is done by "job" or piece work and as much as possible of such work is given to these contractors with the object of keeping them employed on the estate and so prevent their drifting to other properties or outlying districts in search of employment and to the detriment of their holdings.

Crops.

13. Despite the reduction of the area under cacao cultivation for experimental and other purposes and the fact that abnormal weather conditions prevailing during 1934 resulted in a short crop throughout the island, it is to be noted that the yield of River Estate was 1,199 bags, a slight increase over the previous year and making a 3 years average crop of 1,229 bags which constitutes a record in the history of the estate.

14. The cultivation was maintained in good order, and particular attention was paid to the planting and maintenance of supplies, as a result of which the number of "blanks" has been very considerably reduced.

15. The "Propagation Plots", covering an area of 6 acres in Field 25 B, were trenched with pen manure, as also the whole of the remaining portion of Field 19, which surrounds the New Variety Trial Plots, the whole of 23A and approximately $\frac{2}{3}$ of both 23B and 23C.

16. A large portion of Field 18 on which cacao has ceased to be economic, due to unfavourable soil and other conditions, has been interplanted with Robusta coffee and Tonca Beans. The outcome of this will be watched with interest as there are so many estates throughout the colony where exactly such conditions exist and on which a process of gradual supercession of uneconomic cacao by other crops would be a sound policy to adopt.

17. Thrips and cacao beetles were not much in evidence and caused little damage. Rosellinia root disease still persists particularly on low lying sandy areas. As regards witchbroom disease, while the area affected has extended appreciably, the intensity of attack has not increased, and so far as River Estate is concerned this disease has in no way as yet adversely influenced the crop. During the year 875 brooms were cut away and buried.

Experimental Work on Cacao.

18. This work has been continued as usual, all records have been carefully kept and submitted to the Head Office or to the officers of the Imperial College responsible for the various plots, at the close of the experimental year, i.e. 30th September of each year. The New Cacao Variety Trial Plots comprising 12 acres in Field 19 are making good growth. The greater portion of Field 9A has been taken over by the Cacao Research Staff of the Imperial College for fertilizer experiments and has added considerably to the record keeping work of the estate's staff.

Grapefruit and Oranges.

19. The grapefruit and orange crops were record ones and amounted to 1,177 and 488 cases, respectively. The colour, size and texture of all fruit were particularly good and the percentage of grapefruit packed and shipped worked out at approximately 75 per cent. of the total delivered to the Citrus Growers Association as compared with 56 per cent. for the colony as a whole. Prices, however, were disappointing for grapefruit which realized only \$674.78; oranges realized \$467.57.

20. During the year some 47,000 grapefruit and 3,000 orange buds were supplied to the St. Augustine Nurseries and to various planters for propagation purposes.

21. The whole of the citrus cultivation again received good cultural treatment and careful attention was paid to supplying missing trees and to the treatment of diseases. All badly diseased trees were removed and replaced by healthy young plants. Bordeaux wash was applied to all trees, draining and roundridging was proceeded with, and a liberal supply of pen manure was applied to those portions which had not been so treated in 1933; $2\frac{1}{2}$ lbs. of Ammophos and $\frac{1}{2}$ lb. Sulphate of Potash was applied to each tree on the old section south of the mango field. The treatment of the immediate area around the trunks of the trees with oil or mortar has proved very helpful in the control of gummosis, weeds and ants.

Mangoes.

22. The young Julie mango cultivation covering an area of some 6 acres continues to make good growth but has not yet produced a crop of consequence due to blossom injury by Mango Midge and Anthracnose. Approximately 2,000 fruit were sold on the spot and realized a sum of \$21.24.

23. A new driving road measuring 1,496 feet passing between the citrus and mango section and forming a loop through the latter was constructed during the year. This has proved to be a useful improvement and will facilitate the transport of manure and produce to and from both cultivations.

Limes.

24. The lime crop was a record one and yielded 760 barrels of 160 lbs. each as against the previous crop of 572 barrels. The crop realized a sum of \$1,559.08 and was disposed of mainly to Messrs. Alston & Co., Ltd., and a small quantity to the Citrus Growers Association as green limes for shipment. This increase of crop was due chiefly to better weather conditions, to an application of fertilizers during the month of April ($2\frac{1}{2}$ lbs. of Ammophos, plus $\frac{1}{2}$ lb. Sulphate of Potash per tree) and partly to the taking over of a small contract early in the year. There are now 14 contractors planting limes, several of whose contracts will be fit to take over within the next few years.

Tonca Beans.

25. This crop was not as good as the previous year's and amounted to 69 lbs. cured beans and 11,850 pods sold for planting purposes. The total income from tonca beans was \$180.90. A fairly large number of pods were used for our own plantations.

26. Work in connection with the vegetative propagation of this plant by layering has given highly satisfactory results and may justly be claimed to have passed the experimental stage. A two-year old layered plant which has come into bearing is now carrying a crop of 20 nearly mature fruit. A two-acre plot of layered plants interplanted with Robusta coffee has been laid out. There are at present 12 contractors extending the plantation of this crop with Robusta coffee interplanted.

Coffee.

27. The coffee crop, principally C. robusta, was fairly good and amounted to 4,331 lbs. which was sold for \$314.11. This produce is obtained from trees interplanted in the old cacao fields Nos. 14, 15 and 16 and has proved a very useful and profitable intercrop. With the recent and continuing substitution of coffee along the hedge rows of the cacao cultivation in place of Hibiscus which is gradually succumbing to root troubles, and the extension of this crop otherwise, there must shortly be a considerable increase of production and it will soon be necessary to consider the installation of suitable machinery for the handling of the crop. It might then be possible to induce the peasant proprietors of the district to bring in their coffee for pulping and hulling and thus lend an impetus to the industry in the district.

Timber.

28. General improvements to this branch of development have been made by thinning and cutting out of diseased trees. This work was started in 1933 and some of the cuttings from the more accessible areas were converted into fuel wood and sold for a sum of \$78.00. During the year some 3 miles of new bridle roads were constructed and a number of new contracts, which have all been duly registered, were given out. There are now actually 34 contractors planting timber on the estate and it is estimated that the total area under cultivation inclusive of that held by contractors is approximately 600 acres. The total inclusive cost of the timber plantations to 31st December, 1934, stands at \$13,431.69 and the results appear to have fully justified this outlay. That the re-forestation of fairly large areas of denuded hill-sides or otherwise valueless lands is a practical and comparatively quick and cheap possibility is amply demonstrated by the results obtained at River Estate within the last 15 years. This fact is brought vividly to mind as one contemplates the denuded expanse of broken hills and gullies between Fort George and the St. Ann's Valley and mentally visualizes the enhanced value and scenic effect, if 20 years ago, these areas had been systematically planted with Cypre and Poui on the higher slopes and ridges and Cedar and Mahogany in the more sheltered gullies, with an occasional Flamboyant at conspicuous intervals to lend additional colour to the scenic effect of the whole.

Works and Buildings.

29. Slight repairs to buildings were undertaken throughout and the Manager's Quarters received a much needed painting. A very great improvement was the oiling of approximately 2/3 of the yard which work is still being proceeded with and it is hoped by the end of the current year to have the whole yard thoroughly surfaced. No special sum was voted for this work which was carried out entirely from savings on the maintenance and improvement votes.

Stock.

30. The stock all kept well. During the year 2 calves were born and the young Holstein bull born in April, 1933, was sold to Mr. H. Melizan for a sum of \$120.00. The stock comprises 7 head of cattle, 5 horses and 3 mules.

Truck.

31. The Ford motor truck was kept in continual use and has given very satisfactory service.

Visitors.

32. Planters, officers of the Department of Agriculture and of the Imperial College paid frequent visits to the Estate and the Conservator of Forests inspected the timber plantations during the month of May.

33. In conclusion I must again express my thanks to the staff for their willing co-operation and help throughout a very busy year.

RODERICK O'CONNOR,

Manager, River Estate.

26th April, 1935.

RIVER ESTATE.**Statement of Revenue and Expenditure for year ending 31st December, 1934.**

Particulars.	Revenue.	Particulars.	Expenditure.
	\$ c.		\$ c.
By sale of :—		Personal Emoluments	5,008 00
Cocoa (Manuf.) .. 11,748 32		63—Maintenance	13,198 09
Cocoa Pods 23 23	11,771 55	64—Travelling and Transport	1,194 70
Coffee	331 20	65—Incidentals	272 96
Pasture and Service fees .. 167 25		66—Timber Contracts	958 77
1 Holstein Bull .. 120 00	287 25	67—Improvements	1,826 10
Grape fruit 676 33		68—Fertilizers	236 50
Oranges 577 86	1,254 19	69—Materials	584 85
Limes	1,559 08	70—Stock	832 34
Tonca Beans	185 42	71—New Cacao Variety trial	480 00
Miscellaneous :—			
Firewood, provision, &c. 373 06			
Bananas 140 91			
Mangoes 21 24	535 21		
	15,923 90		24,592 31

RIVER ESTATE.

Rainfall for the year ending 31st December, 1934.

Date.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Totals.
1	..	.00	.00	.00	.04	1.00	.14	.00	.96	.25	.00	.00	.00
2	..	.80	.06	.31	.14	.09	.00	.00	.20	.00	.00	.48	.50
3	..	.30	.00	.00	.00	.00	.12	.40	.60	1.04	.00	.73	.10
4	..	.00	.00	.00	.00	.00	.00	1.48	.00	.00	.47	1.90	.00
5	..	.00	.16	.00	.00	.00	1.90	.47	.50	.00	.45	.35	.00
6	..	.10	.03	.00	.09	.00	.00	.00	.25	.00	.13	.00	.18
7	..	.66	.00	.00	.26	.00	.00	.00	.60	1.70	1.02	.48	.50
8	..	.12	.00	.00	.04	.00	.00	.25	.90	.00	.00	.15	.48
9	..	.09	.00	.00	.00	.00	.43	.30	.00	.00	.00	1.35	1.02
10	..	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
11	..	.00	.00	.00	.00	1.00	.00	.00	.40	.59	1.14	.30	.00
12	..	.11	.00	.00	.00	.82	.00	.30	.50	.25	.85	.76	.00
13	..	.00	.00	.00	.00	.00	.30	.00	.00	.54	.59	1.35	.04
14	..	.11	.07	.00	.00	.00	.00	.00	.00	.00	.61	.00	.21
15	..	.14	.09	.00	.00	.01	.00	.00	.37	.52	.00	.00	.35
16	..	.20	.00	.00	.00	.06	.00	.00	.00	.00	.57	.00	.00
17	..	.00	.00	.00	.00	.05	.00	.00	.55	.22	1.04	.18	.06
18	..	.00	.00	.41	.00	.00	.00	.00	1.10	.00	.22	.52	.07
19	..	.00	.00	.00	.00	.00	.00	.00	.35	.00	1.38	.88	.04
20	..	.00	.14	.00	.00	.87	.00	.00	.00	.00	.32	.68	.15
21	..	.10	.00	.00	.00	.00	.00	.62	.10	.00	.00	1.20	.36
22	..	.00	.14	.00	.00	.21	.00	.00	.65	.00	.16	.00	.06
23	..	.00	.00	.09	.00	.00	.00	.00	.00	.49	.00	.00	.35
24	..	.00	.00	.00	.00	.00	.12	.00	.10	1.10	.00	.00	.00
25	..	.00	.00	.00	.00	.00	.00	.00	.00	.90	.00	1.10	.09
26	..	.00	.67	.00	.00	.00	.18	.00	.38	.35	.17	.05	.12
27	..	.00	.00	.00	.00	.00	.00	.00	1.49	.00	.28	.00	.00
28	..	.00	.00	.04	.00	.00	.00	.25	.00	.55	.09	.00	.00
29	..	.00	—	.00	.00	.00	.00	.06	.00	.00	.00	.54	.00
30	..	.00	—	.00	.49	.00	.32	.00	.00	.00	.00	.00	.08
31	..	.00	—	.14	—	.00	—	.00	—	—	.09	—	1.80
Totals	..	2.73	1.36	.99	.97	4.11	3.51	4.13	10.60	8.50	9.58	13.00	6.56=66.04

RIVER ESTATE.

Progressive Abstract of Expenditure for the year 1934.

		\$	c.
" A "—STAFF :			
Manager .. .. .	.. .. .	2,160	00
Overseer, Drivers, Watchmen .. .. .	.. .. .	5,081	50
Travelling, Messenger, &c. .. .. .	.. .. .	330	35
			5,571 85
" B "—MAINTENANCE :			
Roads and Bridges .. .. .	.. .. .	353	40
Buildings Repairs, &c. .. .. .	.. .. .	270	21
Yard and Sanitation .. .. .	.. .. .	652	93
Grass Field .. .. .	.. .. .	..	..
Pastures .. .. .	.. .. .	105	26
Water—Service and River .. .. .	.. .. .	61	38
Materials (Tools, Bags, &c.) .. .. .	.. .. .	528	00
Visitors and other Public Services .. .. .	.. .. .	408	11
Miscellaneous .. .. .	.. .. .	..	..
			2,379 29
" C "—STOCK :			
Labour, Stock-keeper, Grass Cutter, &c. .. .. .	.. .. .	597	13
Materials—Stock feed, Repairs, Cart harness .. .. .	.. .. .	635	84
			1,232 97
" D "—LORRIES.			
Labour, Chauffeur and Attendant .. .. .	.. .. .	808	19
Upkeep, gasoline, oil, repairs, &c. .. .. .	.. .. .	302	65
			1,110 84
" E "—NURSERIES :			
Establishment .. .. .	.. .. .	..	..
Maintenance .. .. .	.. .. .	..	..
Total " A " to " E "		..	28 13
			10,323 08
" F "—COCOA CULTIVATION :			
Cutlassing .. .. .	.. .. .	1,720	17
Weeding and Stumping .. .. .	.. .. .	311	87
Trenching and Mulching, Manuring .. .. .	.. .. .	873	33
Supplying Cocoa and ground shade .. .. .	.. .. .	373	97
Pruning .. .. .	.. .. .	599	77
Draining and Roundridging .. .. .	.. .. .	84	39
Burying Pods—Bury Cacao shells .. .. .	.. .. .	345	89
Shade Control .. .. .	.. .. .	23	34
Hedges and Borders .. .. .	.. .. .	68	67
Diseases and Pests, Ants, Beetles, Squirrels, &c. .. .. .	.. .. .	87	30
Witchbroom .. .. .	.. .. .	87	54
Miscellaneous .. .. .	.. .. .	..	..
			4,576 24
" G "—COCOA MANUFACTURE :			
Reaping .. .. .	.. .. .	1,951	98
Curing and bagging .. .. .	.. .. .	579	32
Total " F " and " G "		..	2,531 30
			7,107 54
" H "—COCOA EXPERIMENTS :			
Labour .. .. .	.. .. .	1,572	19
Materials .. .. .	.. .. .	..	..
			1,572 19
" I "—ORCHARD—GRAPE FRUIT AND ORANGES :			
Upkeep—Cutlassing, weeding, supplying, &c. .. .. .	.. .. .	1,131	39
Manuring .. .. .	.. .. .	26	00
Reaping .. .. .	.. .. .	106	57
			1,263 96
" J "—LIMES :			
Upkeep—Cutlassing, Supplying, &c. .. .. .	.. .. .	249	52
Manuring including artificial manure .. .. .	.. .. .	164	00
Reaping .. .. .	.. .. .	358	46
			771 98
" K "—TONCA BEANS :			
Upkeep—Layering experiment, Cutlassing, &c. .. .. .	.. .. .	134	47
Manuring .. .. .	.. .. .	..	..
Reaping .. .. .	.. .. .	8	40
			142 87
" L "—MANGOES :			
Upkeep—Cutlassing, draining, &c. .. .. .	.. .. .	40	67
Manuring .. .. .	.. .. .	..	..
Reaping .. .. .	.. .. .	90	..
Total " I " to " L "		..	41 57
			2,220 38
" M "—TIMBER CULTIVATION :			
Upkeep—Cutlassing, thinning, clearing vines .. .. .	.. .. .	645	80
Roads and Bridges .. .. .	.. .. .	104	40
Reaping—Sawing and transport of timber .. .. .	.. .. .	130	88
			881 08
" N "—EXTRAORDINARY :			
New Cultivations—			
Cocoa .. .. .	.. .. .	55	92
Grapefruit and Oranges .. .. .	.. .. .	53	29
Tonca Beans and Coffee .. .. .	.. .. .	390	82
Timber .. .. .	.. .. .	236	90
New Roads and New Bridges .. .. .	.. .. .	1,006	81
Purchase of Contracts, advances, &c. .. .. .	.. .. .	338	28
Miscellaneous—Oiling Grapefruit, yard, Limes, &c. .. .. .	.. .. .	406	02
			2,488 04
Grand Total		..	24,592 31

Field No.	Bearing Trees.	Half Trees.	Quarter Trees.	Supplies.	Dead or missing Trees.	Total.	Acreage.	Appr. Age.	1934.		1933.		REMARKS.
									No. of bags of 165 lb.	No. of bags per acre.	No. of bags of 165 lb.	No. of bags per acre.	
1 A ..	2,394	215	161	40	552	3,362	11.8	31-37	30.13	2.5	28.24	2.3	Part trenched without manure 1931-1932 ; Completed 1933.
1 B ..	1,145	114	117	24	377	1,777	6.2	31-37	8.03	1.3	12.51	2.1	Part trenched without manure 1931-1932 ; Completed late 1933.
2 A ..	1,444	247	171	179	148	2,189	11.1	61-67	22.27	2.1	20.38	1.8	Experimental field, replacement of poor bearers.
2 B ..	1,331	270	139	100	55	1,901	9.6	61-67	18.61	1.9	18.77	1.9	Experimental field, replacement of poor bearers.
3 A ..	1,824	361	141	196	129	2,651	13.3	61-67	36.26	2.7	33.43	2.5	Part trenched with manure, and part treated with fertilizer, 1931. Part trenched without manure, and part treated with fertilizer, 1931.
3 B ..	1,572	250	67	25	291	2,205	11.3	61-67	26.29	2.3	21.99	1.9	No special treatment.
4 A ..	1,725	139	35	—	779	2,678	9.0	51-62	12.04	1.3	6.61	.7	No special treatment, blanks supplied 1934.
4 B ..	2,011	70	56	—	876	3,016	10.0	51-62	23.73	2.3	21.63	2.1	No special treatment, blanks supplied 1934.
5 ..	2,484	189	147	174	112	3,106	16.4	61-67	57.97	3.5	49.70	3.0	Shade and fertilizer experiments.
6 A ..	2,726	68	99	21	155	3,669	10.2	31-37	35.42	3.4	25.92	2.5	Trenched with manure 1933
B ..	1,849	52	76	8	218	2,203	7.3	31-37	30.50	4.1	16.09	2.2	do.
C ..	1,727	47	69	10	121	1,974	6.6	31-37	33.22	5.3	18.23	2.7	Trenched with manure 1932.
7 A ..	2,314	112	118	50	89	2,683	8.6	31-37	25.93	3.1	23.60	2.7	Trenched with manure 1925.
B ..	2,074	81	91	10	62	2,318	7.5	31-37	31.04	4.1	27.35	3.6	do.
8 A ..	3,557	79	306	179	214	4,335	14.5	31-37	50.67	3.4	38.97	2.6	Trenched with manure 1927.
B ..	1,398	66	105	95	108	1,772	6.0	31-37	24.47	4.7	23.77	3.9	do.
C ..	1,708	66	206	171	202	2,333	7.8	31-37	26.84	3.4	22.89	2.9	do.
9 A ..	1,839	119	158	74	115	2,305	7.8	31-37	27.39	3.5	23.24	2.9	Trenched with manure 1928.
B ..	1,794	60	71	9	174	2,108	7.0	31-37	29.45	4.2	25.20	3.6	Trenched with manure 1928-1929.
C ..	2,461	129	138	249	137	3,114	10.4	31-37	34.87	3.3	27.00	2.5	Trenched with manure 1929-1930.
10 A ..	1,574	87	73	585	—	2,319	7.5	31-37	18.07	2.4	19.66	2.6	Trenched with manure 1930-1931.
B ..	2,034	107	103	533	—	2,777	9.2	31-37	19.17	2.1	23.95	2.6	do.
11 ..	2,233	198	169	505	—	3,105	10.3	31-37	20.81	2.0	23.06	2.2	Part trenched with manure 1931. Rest trenched without manure 1933.
12 A ..	2,847	132	158	122	1,369	4,628	13.8	31-42	24.57	1.7	31.11	2.2	No special treatment ; blanks supplied 1933-1934.
B ..	386	14	7	1	112	520	1.7	31-42	1.83	1.1	1.9	1.1	No special treatment.

COUNTING AND CROP RETURNS.—CONTINUED.

Field No.	Bearing Trees.	Half Trees.	Quarter Trees.	Supplies.	Dead or missing Trees.	Total.	Acreage.	Appr. Age.	1934.		1933.		REMARKS
									No. of bags of 165 lb. per acre.	No. of bags of 165 lb. per acre.	No. of bags of 165 lb. per acre.	No. of bags of 165 lb. per acre.	
13 A ..	2,371	105	141	185	673	3,475	14.0	31-42	54.06	3.9	55.78	3.9	No special treatment; Very good natural conditions.
B ..	1,573	96	82	1	215	1,967	7.8	31-42	37.82	4.8	39.33	5.0	do.
14 ..	982	56	27	1	617	1,683	6.1	61-67	6.02	.9	7.50	1.2	Part interplanted with Robusta Coffee.
15 ..	1,140	40	26	—	665	1,871	5.7	31-92	8.03	1.4	12.51	2.1	Part interplanted with Robusta Coffee.
16 ..	1,888	44	50	232	512	2,726	8.7	31-67	33.27	3.8	37.90	4.3	No special treatment, part interplanted with Robusta (coffee).
17 A ..	2,603	290	168	489	533	4,083	13.3	31-37	24.28	1.8	27.17	2.0	Part trenched without manure 1931.
B ..	2,086	149	137	34	440	2,846	9.3	31-37	19.90	2.1	19.85	2.1	do.
18 A ..	2,722	251	161	148	90	3,372	8.5	11-37	25.37	2.9	32.18	3.7	Distance spacing experiment. One plot treated with Superphosphate.
B ..	2,673	107	89	8	1,050	3,927	13.0	11-37	21.54	1.6	19.30	1.4	No special treatment; interplanted with Robusta Coffee and Tonca Bean late 1934.
19 ..	1,301	101	66	10	70	1,548	5.1	26-37	12.88	2.5	14.47	2.8	Trenched with manure 1934.
20 A ..	2,080	106	140	21	92	2,451	7.0	20-37	23.37	2.0	31.28	3.0	Light shade. Trenched with manure 1926.
B ..	1,361	26	38	63	69	1,557	5.1	26-37	18.25	3.5	21.81	4.2	No shade. Trenched with manure 1924.
C ..	918	13	33	17	78	1,059	3.4	26-37	11.87	3.4	10.26	3.0	No shade. Fertilizer experiment.
D ..	1,684	11	29	6	124	1,254	4.0	26-37	11.87	2.9	11.44	2.8	No shade. Trenched with manure 1932.
21 A ..	1,839	96	58	221	—	2,214	7.6	26-37	34.90	4.5	27.35	3.6	Partial shade. Trenched with manure 1931-1932.
B ..	1,787	156	71	582	—	2,596	8.7	26-37	23.73	2.7	25.38	2.9	do.
22 A ..	1,576	29	166	161	197	2,129	6.6	26-37	16.25	2.4	15.55	2.3	No special treatment.
B ..	2,442	142	288	113	279	3,264	10.2	26-37	28.29	2.7	30.21	2.9	Trenched with manure 1925.
C ..	787	17	77	46	218	1,145	3.5	26-37	10.04	2.8	11.08	3.1	do.
D ..	2,004	107	55	49	134	2,349	7.7	26-37	8.95	1.1	10.94	1.4	No special treatment.
E ..	1,050	10	30	3	123	1,216	3.8	26-37	4.54	1.2	2.67	.7	do.
23 A ..	2,399	44	61	46	208	2,758	10.1	26-37	27.49	2.7	29.85	2.9	Trenched without manure 1924. Re-trenched with manure 1934.
B ..	804	38	56	228	90	1,216	4.4	26-37	8.03	1.8	8.22	1.8	Part trenched with manure 1934.
C ..	1,330	39	61	320	438	2,188	8.1	26-37	12.40	1.5	16.26	2.0	Trenched without manure 1929. Part re-trenched with manure 1934.
24 ..	2,163	137	111	10	430	2,851	9.2	26-37	11.86	1.2	17.34	1.8	Part trenched without manure 1929.
25 A ..	963	10	2	66	123	1,164	3.9	11-32	10.40	2.6	16.09	4.1	New Mulch experiment.
B ..	2,270	106	67	179	169	2,791	9.3	11-32	23.65	2.5	27.89	3.0	Propagation, Progeny and Colour Plots. Trenched with manure 1934.
	02,650	5,604	5,271	6,602	14,032	106,168	420.0		1,700	2.22	1,156.84	15.6	

REPORT OF MYCOLOGIST, 1934.

General.

A notable feature of the year under review was the marked reduction in rainfall as compared with the previous year. Indeed, the first half of the year encountered a severe drought which had its reactions on the crops. It is one of the puzzling features of agriculture in the Caribbean that dry and wet seasons are markedly erratic and it will be generally agreed that excessive dry and wet spells of weather have adverse effects on most of the economic crops grown. This applies in a striking manner to a crop like coconuts, where the maintenance of uniform soil moisture conditions are of great importance. Equally important is the absence of extreme dryness or wetness for the optimum conditions for cacao or citrus.

Sugar Cane.

2. The colony has seen some extension in the planting of this crop in recent times. Some of this development has been occasioned by substitution of cane for cacao; especially has this been in operation in districts where the cacao properties have reasonable proximity to sugar factories.

Diseases of the Crop.

3. Leaf spotting fungi, *Cercospora* sp., and *Leptosphaeria* sp. can be seen in a mild form in most sugar cane districts but to-date these parasites have never become of real economic importance, hence no specific treatment is advised or required.

4. Occasionally patches of root disease are encountered where *Marasmius* sp. is involved; but it is very rare to see uncomplicated root disease on the cane stools. Almost invariably the root disease is associated with frog hopper attack or Moth "borer" damage, or both. Frog hopper and Moth "borer" are specific major pests of cane, and root disease as such can be said to be of comparatively minor importance.

Mosaic Disease.

5. This virus affection, which has now been present in the island for a long number of years, still persists in the North and Central cane belts. When this affection was first discovered, considerable anxiety was felt as to the possible damage to the industry; but to-date no appreciable economic loss can be said to result from the Mosaic infestation. Most of the trouble is to be found in cane farmers' properties; these are very small and numerous, which renders Government supervision difficult. Undoubtedly, most of the spread of the trouble is brought about by planting infested cuttings and the chief control work is to locate diseased stools and rogue them out. By the steady and continuous adoption of this method the affection appears to be kept well in hand.

Bananas.

6. During the year a considerable amount of additional planting of the Gros Michel variety has been done. These plants have mainly been established in open spaces in the cacao fields; but in a number of instances, pure stands of a few acres each, are to be seen. Where the soils are suitable and the environmental factors are favourable, then the plants appear promising. But in many places the soils especially indicate that the plant nutrients are far from the optimum and in such situations a policy of cultural treatment, including manuring, will probably be necessary. One of the difficulties in developing this industry is the limited amount of satisfactory planting material. This has resulted in a considerable amount of indiscriminate planting with potential perils in its wake. There is a fair amount of disease in the old stools of this crop; also the "borer" pest is quite prevalent. Hence the acquisition of absolutely sound and healthy planting material is somewhat limited. Planters are, therefore, urged to use their own suckers, &c., to as great a degree as possible; and those who contemplate extensive planting are recommended to establish their own nurseries.

Diseases.

Panama Disease.

7. This affection, caused by *Fusarium cubense*, has been known to be present in the island for a long number of years. In recent months, owing to additional planting, a considerable increase in incidence is to be seen. Some estates have a fairly high incidence, even in plants which are producing their first crop, and scattered failing stools are to be found in practically every district where the crop is grown. All this means that strict vigilance is necessary by all growers if the disease is to be kept within manageable limits.

'Moko' (bacterial) Disease.

8. During the year this affection was found to be attacking the Gros Michel variety. It is most in evidence in lands recently cleared from high woods. Moreover, it is also found sporadically in areas where Moko plantains have been grown and failed from the same disease. In typical examples of the disease, the leaf symptoms are almost absent. Transverse sections of diseased shoots reveal that the affection is localised in the centre tissues; in this area the vascular bundles are discoloured. A useful method of diagnosing the disease is to observe the conditions in plants which possess fruit bunches. In such cases individual fingers scattered indiscriminately on the fruit bunch are found to be prematurely yellowing; also the fruit stalks have discoloured vasculars. Though the symptoms outlined above can be said to be typical, instances of this disease have been found recently where general collapse of the foliage has taken place in the early stage of infection and cross sections of the pseudostem show discoloured vasculars in the severed leaf-bases which on examination produce the typical bacterial exudation.

Leaf-Spotting Fungi.

9. A number of these weakly parasitic fungi are found on the several varieties of bananas but none of economic significance are known on the Gros Michel, which is the one that is being grown for export purposes.

Control of Banana Diseases.

10. Banana Disease Killer Oil (B. D. K. Oil) is now the stock method of handling diseased stools. The whole of the planting community has had the opportunity of seeing demonstrations in the use of the oil; and selling stations are located in suitable centres where planters can procure supplies. This method of dealing with diseased plants is comparatively cheap and effective. Where a diseased stool (or stools) has been dosed with B. D. K. Oil, the grower is recommended to place a picket (or pickets) on the affected site so as to definitely locate it. Three or four pickets on an affected site also has the additional advantage of protecting the place by keeping labourers and others from walking on possibly infected soil.

Experiments with Poisons for Killing Diseased Banana Plants.

11. Though Banana Disease Killer Oil has proved definitely efficacious in killing diseased stools, still it was considered advisable to try other substances in this work to determine if an equally useful and cheaper method was possible. For this purpose, large numbers of diseased stools were experimented upon with:

- (a) Sodium Arsenite (various strengths).
 - (b) Phenolic Oil (20 per cent. strength).
 - (c) Sulphemulsol (do. do.).
 - (d) Spent Soda.
 - (e) Spent Soda Liquor.
- (a) was tried at 1 lb. to 1 gallon of water.
- | | | |
|-----|------------|-----|
| do. | 1 lb. to 2 | do. |
| do. | 1 lb. to 3 | do. |
| do. | 1 lb. to 4 | do. |

12. At 1 lb. to 1 gallon of water Sodium Arsenite was fairly effective, but not nearly as good as B. D. K. Oil. It is highly desirable that the agent used for destroying diseased stools should be sufficiently effective so that retreatment is unnecessary.

13. B. D. K. Oil can be relied upon in this respect, but Sodium Arsenite cannot, even at a strength of 1 lb. to 1 gallon of water. Stronger solutions of Sodium Arsenite would make the cost in excess of that of B. D. K. Oil; (b), (c), (d), and (e) were all less effective than Sodium Arsenite.

14. The Department is indebted to Messrs. Trinidad Leaseholds, Ltd., for supplies of (b), (c), (d), and (e) for the above experimental work.

Coconuts.

15. For a few years now, since the slump in prices, this crop has been somewhat neglected. Even at the best of times, when the produce commands relatively high prices, the coconut cultivations receive only extensive as against intensive attention. This applies in a general way; there are coconut estates where fairly good and sustained work of a cultural kind is systematically executed. Unfortunately, only a minor percentage of the lands planted in this crop in the colony are in what are known as excellent coconut soils and therefore thrive even if attention is more or less indifferent. On the other hand, considerable areas are established in coconuts in various parts of the island where soil conditions and environmental factors are far from ideal with the result that judicious cultural work is necessary if success is to be achieved. It is problematical to what extent cultural work would be effective in some of the plantations where the trees are 15 to 20 years old and where signs of failure are showing themselves. The most important point is that where it is generally agreed that the palms are established in mediocre soils and where rainfall, &c., are defective or insufficient, then methodical and continuous cultural operations should be prosecuted from a young stage in the life cycle of the trees.

Diseases of the Crop.

Bud Rot (Phytophthora Sp.)

16. Bud Rot has never been known to do extensive damage in the colony, though other affections are often confused with this specific disease.

Red Ring.

17. Formerly this pest was much more in evidence than it is at present, the reason being that large numbers of trees are now beyond the susceptible stage of infection. This affection is comparatively easy to diagnose by the method of tree dissection and planters generally are quite familiar with the trouble. It is quite possible that the affection is carried in the husks of seed nuts and planters are recommended to remove the husks before planting.

Little Leaf.

18. This affection is much more pronounced in some districts than in others. When detected in the early stages, remedial treatment is usually successful if thoroughly executed. This treatment consists in reducing constriction in the crown tissues by severing the strainers and pouring a substantial amount of dilute disinfectant into the crown of the tree. An additional useful procedure is to fork around the base of the tree and apply manure.

Wilt.

19. What is known as the wilt affection is the most serious of the maladies of this crop. At the present time it is conspicuous in many places; sometimes large numbers of trees collapse in the space of a few months. There is every likelihood that the soil complex, plus environmental factors are primarily responsible for the high mortality. This affection has been under investigation by a number of workers for several years and it appears to be generally agreed that the soil moisture factor is of vital importance. It is to be hoped that in the projected irrigation proposals for the colony that some provision will be made for irrigating coconuts during periods of drought which occur practically every year.

Citrus.

Limes.

20. The growing of this crop seems to possess a peculiar fascination for planters, both small holders and large estates. In practically all parts of the island one sees this crop established and in many places expansion is proceeding.

21. The worst affection of the ordinary West Indian Lime is the wither-tip disease (*Gloeosporium limeticolum*) which attacks young tissues (leaves, shoots, flowers, and fruits). In normal years, when the main flushing and blossoming period occurs in a dry spell of weather, good crops can be relied on in the low rainfall zones. But in areas of high rainfall, good crops are exceptional.

22. A useful development has been the production of the T.1 lime, by hybridization. This is immune to the above named disease; moreover, it crops freely and early and should materially assist in stabilizing the industry in the wetter districts, providing it satisfies the requirements of the market and also that marketing facilities are available.

Oranges.

23. The common cacao orange has an extensive range in the colony, being co-extensive with the cacao properties. This orange is greatly favoured locally and in adjacent territories, though its external appearance is somewhat unattractive. Perhaps the most serious pest of the crop is a fly (*Anastrepha* sp.). This, in some years, is a serious factor in reducing the amount of saleable fruit, but a more important consideration is that this pest has powers of migrating to the budded oranges and grapefruit.

Grapefruit.

24. The growing of this crop is steadily being extended. The variety most in favour is Marsh. In the past many mistakes have been made in the nursery and the field which have caused trouble and premature death of plants. But it is now felt that sufficient local experience is now available for growing the crop and that appreciably better results can be expected in the future. It is difficult to change the habits and practices of planters in a short period of time; such required changes, however, are demanded to produce success in a citrus orchard. It should be a routine practice in citrus fields to inspect every tree carefully at intervals of six (6) months to ascertain if an affection like Gummosis is present. This trouble, if present, should be promptly dealt with by excising the affected tissues and destroying them, preferably by burning. A coating of Bordeaux paste should then be applied to the exposed surfaces.

25. Close co-operation between the planters and the Department is called for in the growing of grapefruit and oranges from the initial propagation work in the nursery and onwards to the maintenance of optimum conditions for growth and fruit production; and in addition for effective measures in disease and pest control.

Cacao.

Witchbroom Disease (*Marasmius perniciosus*).

26. The economic status of the cacao industry having been unsatisfactory during the past few years, has rendered the control work for this disease very difficult. Hence it is not surprising to find some extension and intensification of the affection in the several cacao growing districts. The long drought in the first half of the year gave planters an excellent opportunity of removing and destroying large quantities of diseased material prior to the fructification period; but unfortunately very few growers were in a position to make effective use of it. It is felt that if extra efforts could be made in control work before the May to June rains and also during and following the short Indian Summer prior to the anticipated November and December rains, then the incidence of witchbroom would be less.

Loss of Crop.

27. It is but natural that this aspect of the disease is of first importance. It was known from the time of the discovery of the affection in March, 1928, that cacao pods of all sizes were attacked and the contained beans spoilt. Crop losses have been operating from that time up to the present and in the future they will continue to operate.

28. It is doubtful if any estate except the Government property in South Manzanilla has reliable data on crop loss covering complete years. Last year (1933) the loss of mature pods at Marper (Government) Estate was about one per cent. of the total crop. For this year (1934) the figure is about two per cent. But it must be remembered that the whole of this estate has had a collection and destruction of diseased material made once a month. The cost of this work is high and non-economic at present prices of cacao. The fact remains, however, that even in the worst infected zones it has been demonstrated that by systematic attention, crop losses can be kept at a reasonably low point.

29. Though the above results have been achieved on this one property and though accurate figures are unavailable for other estates, still it is known that substantial losses of mature pods are operating. It is safe to say that losses of 5 to 10 per cent. are common in some districts; and losses in appreciable excess of these figures are probably occurring on several properties.

Search for Witchbroom Resistant Trees.

30. During the year 150,000 cacao trees, approximating to 500 acres, located in the worst infected areas, were searched to determine disease incidence and to ascertain by subsequent monthly inspections if any showed high resistance or immunity to witchbroom. By the middle of the year it was found that 108 quarter trees, 81 half trees, and 132 full trees were still free of witchbroom. This made a total of 321 trees. At the end of the year the "free of disease" trees numbered 92, made up of 29 quarter trees, 17 half trees, and 46 full trees. It is quite likely that in the next few months a big percentage of the remaining 92 trees will be eliminated by the ordinary process of natural infection.

Nurseries of Resistant Trees.

31. Small nurseries have been set up at Marper and a few other estates of selected pods from trees possessing high resistance to witchbroom.

Introduction of Resistant Cacao Types.

32. Through the kind assistance of the Surinam Government, material for propagation has recently been received and sent to the Quarantine Station at the Imperial College of Tropical Agriculture at St. Augustine.

Disease in Immortal Trees.

33. Immortal trees (*Anauca* and *Bocare*) constitute the typical and dominant shade trees in the cacao fields in Trinidad. In the flats and areas of low elevation, the Bocare is commonly found; the *Anauca* is typically present at the higher elevations. For some time, numbers of immortels have been dying in the Sangre Grande and Manzanilla districts. Nearly all the shade trees in these areas are the Bocare immortal; only a small percentage are *Anauco*. Both the *Anauca* and Bocare are attacked by disease. But it must be clearly understood that several agencies other than specific disease are periodically responsible for losses of shade trees in cacao. Of these, wind storms are probably the most important; other agents are water-logging, where drainage is poor or absent; in other cases, a form of top rot sets in, especially in old trees. In some places a combination of the above has operated. To these factors must now be added a fungus disease caused by a species of *Sphaerostilbe*.

34. The affection is typically present on the sides of streams in low-lying land liable to periodical flooding. The chief foci of infection are one or more points on the basal parts of the stems; occasionally other points, such as the forking of the trees, constitute the areas of initial infection.

35. The fungus in question is normally regarded as a saprophyte and some predisposing factor is necessary for it to assume the role of a parasite. In this instance, no doubt, the trouble is brought about by flood waters depositing infected debris against the shade trees and setting up infection.

36. Fructifications of the fungus, both stilbum and perithecial stages, are conspicuously present. It is to be noted that this fungus has not been found to attack the cacao trees.

37. The attacked shade trees are old specimens mostly upwards of 40 years of age. They have reached their maximum utility long ago. It is said that in an ideal cacao estate shade trees of the immortal variety should be replaced after 25 years.

38. The treatment recommended for the dead trees is first to scorch the areas where the fructifications are visible; then fell and burn the trees when conditions are favourable. In the ordinary way, cacao fields have far too many shade trees; hence some amount of reduction is useful both for minimising loss from 'black pod' (*Phytophthora* sp.) and also witchbroom, especially if the cacao is situated in low-lying and well-sheltered situations. On some properties, shade reduction by human agency has been in operation for a considerable time and it is suggested that the presumably healthy shade trees in the districts where the disease is prevalent should be protected by coating the basal portions of the stems with colas.

39. Where it is necessary to replace some of the shade trees, it is recommended that *Gliricidia* sp. or some trees other than immortels, be planted. There is the further big problem, viz.: can anything be done to prevent flooding in these areas? This is a problem in agricultural engineering and may be some amelioration of conditions is possible.

Visits.

40. The writer spent two weeks in Tobago in December on a tour of inspection of crops and particular attention was given to determine the incidence of diseases. It is gratifying to report that Tobago is reaping an excellent cacao crop. In the Leeward district of the island, coconuts are the dominant crop and these were adversely affected by the prolonged drought in the first half of 1934. Consequent on that dry period much shedding of young nuts took place and the vigour of the trees retarded. However, since then, and with the advent of the wet season, the trees have resumed a normal appearance. Sporadic cases of Little Leaf disease and the Red Ring pest are to be seen in the several cultivations, but the planters generally are now fairly familiar with these maladies and the methods of control.

41. Some of the Tobago planters are establishing small blocks of Gros Michel bananas as pure stands; in addition, the planting of this variety is being undertaken in open places in cacao and coconut fields to an appreciable degree. At present, production is small, but hopes are entertained of substantial increases within a twelvemonth.

42. Tobago, like Trinidad, is menaced by the presence of "borer" (*Cosmopolites sordidus*) in its musaceous plants (bananas and plantains). This is regrettable because it is felt that if strict field sanitation methods were constantly practised, then the successful growing of plantains on a much larger and profitable scale would result.

43. Opportunity was taken during this visit to demonstrate the methods of controlling "borer" by trapping methods; also planters were shown the way to apply Banana Disease Killer Oil to diseased stools. At present, the known incidence of diseases of bananas in Tobago is very small and if rigid control measures are exercised some success should result.

44. As usual, large numbers of properties were visited in Trinidad during the year, most attention being given to those embarking on the growing of Gros Michel bananas. But cacao, coconut, and citrus properties were inspected as time and opportunity offered. The most effective way of instructing proprietors on the question of diseases of crops still appears to be the one where demonstrations are made on the spot to the planters concerned.

Miscellaneous.

Corn (*Zea Mays*).

45. This crop is grown as a subsidiary practically throughout the island by small holders. It is not known to be attacked by disease to any definite economic extent. However, there are records, almost annually, of sporadic attacks of smut (*Ustilago Zea*). During the present year, the incidence of this disease in some areas has been appreciably larger, reaching in one or two instances to one or two per cent. The malady is so uncommon in most districts that the growers regard it as a curiosity and general spread of the trouble is unknown. When affected plants are located they should be carefully collected and destroyed on the spot by burning.

Avocado Pear (*Persea gratissima*).

46. This tree is very susceptible to *Rosellinia* root disease. It is commonly grown interplanted in cacao fields and one frequently encounters dead and dying trees attacked by the above parasite. Avocado pear trees, in these situations, often become centres of infection for the spread of the disease to cacao and other crops. Because of this, it is definitely inadvisable to plant this fruit tree in cacao fields.

Ground Nuts (*Arachis hypogaea*).

47. Owing to the prevailing depression, the stimulus engendered thereby to develop minor industries, this crop is receiving more attention nowadays so as to reduce the volume of importations of this kind of produce which is fairly substantial.

Leaf-Spotting Fungi.

48. Two leaf-spotting fungi have been found on ground nuts, viz.: a rust (*Uredo* sp.) and a species of *Cercospora*. Neither of them has assumed economic importance.

F. STELL,
Mycologist.

REPORT ON WILT DISEASE OF COCONUTS FOR 1934.

During the year 1934 coconut wilt investigations were carried out under the following headings:—

- A. Moisture determinations.
- B. Studies of the root systems of healthy and affected palms.
- C. Analyses of the ash of leaves.
- D. Field experiments with watering and fertiliser treatments.

A.—Moisture Determinations.

It was pointed out in my report for 1933 that, on account of the abnormally wet weather experienced during that year, no indication of the moisture status of contrasted soils during a normal dry period was obtained. Moisture determinations were, therefore, done on weekly samples taken during the first six months of 1934. The depths of samples were the same as previously described.

The plots were as follows:—

- (a) Healthy field—La Florissante Estate, D'Abadie.
- (b) Wilt field—La Florissante Estate, D'Abadie.
- (c) Healthy field—Endeavour Estate, Chaguana.
- (d) Healthy field—Endeavour Estate, Chaguana.

In all plots available moisture was ample from January until the middle of March, plot (b) having the highest percentage. From that period until June the available moisture was very low in all plots, being practically nil for plots (a) and (b) at the end of May. It will be seen that, during the drought period, as far as the top two feet of soil are concerned there was no difference in the available moisture status between soils of the contrasted wilt and healthy plots.

B.—Root Studies.

From general soil considerations it would appear that the physical and allied water relationships of the soil are very useful in classifying soils on which the disease is likely to occur. Such a classification aids in the discussion of the contrasted root systems of "Wilt" and healthy plants to be discussed presently.

Wilt soils will, therefore, be classified as follows:—

- (1) Surface soil is close-textured and overlies a subsoil which is impervious to water. Such a soil is subject to water-logging during wet periods and liable to dry out quickly during periods of drought.
- (2) Soil and subsoil are open textured and free draining. This leads to a relatively poor water supply during dry weather.
- (3) Friable top-soil with an intolerant subsoil layer.

Root Systems of Trees in Healthy Area.

Root development in the first foot is very great, many branch roots and feeding rootlets being present. The numbers decrease gradually in the second and third foot but are still appreciable. In the lower depths to six feet there are still roots to be found, the majority within a six foot radius of the bole. White growing tips are observed even in the lower depths, the soil being quite moist.

Root Systems of Trees on Soils of Class (1).

Root development in the first foot is very good, many feeding rootlets being present. In the second and third feet the development is generally good, but in some instances rotting roots may be observed near the bole of the tree. Below this layer the soil is usually water-logged and a mass of rotted roots are encountered. This layer may even be as high as 2 feet 6 inches. Where water-logging is excessive. It is evident that previous to water-logging roots penetrate this layer but are killed out in the ensuing wet period.

Root System of Trees on Soils of Class (2).

Root development may be observed to a depth of usually about 4 feet. The numbers of main and branch roots, as well as feeding roots, are much less than in the case of healthy trees. Many of the roots while appearing otherwise healthy show black patches at various points. Usually the blackening does not extend to the central conducting strand, but in some instances this is evidently broken.

Root System of Trees on Soils of Class (3).

This class refers to soils of the Princes Town Marl type.

Root development is comparatively good until the Marl layer is reached. Very few roots penetrate into this layer. Where Wilt occurs this layer is usually at a depth of two to three feet. Where the layer is deeper Wilt is apparently not very prevalent. The roots in the top layer while not exhibiting what may be considered a diseased condition have a very thick outer covering.

There are some instances where the soils are not typically free draining, but the root systems are very similar to those of trees growing on soils of Class (2). These soils dry out quickly during periods of drought.

Evidence was obtained that in some instances root absorption had ceased previous to the external leaf symptoms of the disease being apparent.

It will be seen that there are obvious differences between the root systems of plants in healthy areas and those growing on Wilt areas of the respective soil classes.

C.—Analyses of the Ash of Leaves.

Samples of leaflets from the youngest and oldest leaves on respective healthy and Wilt trees were taken and the following determinations made: Nitrogen, Ash, Phosphate, Potassium, Calcium and Magnesium.

Generally speaking when the average percentage of the respective nutrients studied in contrasted healthy and diseased trees are considered there is no striking difference to be observed up to the present time. If the samples are considered according to the soil classes on which they occur the following conclusions may be drawn.

- (a) The nutrient status of plants grown on soils of Classes (1) and (3) is generally much the same as that of healthy plants.
- (b) Samples from plants grown on soils of Class (2) are lower in ash and potassium, and higher in nitrogen than plants from healthy areas. The number of samples studied so far from this class is very small and, therefore, no very definite conclusion is warranted at present.

D.—Field Experiments.

I.—Experiments were carried out on individual wilting plants to see if recovery could be accomplished. The soil on which the plants were growing is a sandy alluvium underlain by gravel.

The following treatments were tried with the results mentioned.

- (a) Watering (4 trees)—all died
- (b) Watering Potassium Sulphate (3 trees)—All trees died. Progress of disease was delayed.
- (c) Watering Superphosphate (2 trees)—Both died.
- (d) Watering Ammonium Sulphate (3 trees)—All died very quickly.
- (e) Watering Sodium nitrate (1 tree)—Died.
- (f) Watering Potassium Sulphate Ammonium Sulphate (1 tree)—Recovered. Very healthy, carrying large crop.

Only trees from which young nuts were being shed and with at least six bronze leaves were selected in the experiment. The same treatments, without watering, have been carried out on the same estate on healthy trees to see if the incidence of the disease could be checked. No results are forthcoming as yet.

II.—Large scale experiments on three sites were laid down to try out trenching alone, and in conjunction with fertiliser mixtures on fields where Wilt was progressing rapidly as well as on fields where Wilt was likely to occur in a year or so.

It would appear that in the former instance the treatments have not been successful in checking the progress of the disease. It must be remembered, however, that the year was abnormally dry, a condition especially conducive to the prevalence of the disease. In the latter instance no results are forthcoming as yet.

F. M. BAIN,
Agricultural Officer.



PART III.

ANNEXURES.

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REVENUE AND EXPENDITURE, 1934	54
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ANNUAL RAINFALL, PORT-OF-SPAIN, TRINIDAD	56

APPENDIX A.

Revenue and Expenditure.						Expenditure.	Revenue.
						£ s. d.	£ s. d.
HEAD OFFICE :							
Personal Emoluments	..	..	..	..	..	7,259 4 9½	50 0 0
Travelling and Other Charges	..	..	..	..	..	1,193 17 7	10 0 0
Laboratory Expenses and Field Experiments..	..	..	..	..	..	539 17 10	—
Banana Shipment	..	..	..	..	..	1,387 9 4	2,425 2 0
BOTANICAL DEPARTMENT, TRINIDAD :							
Personal Emoluments	..	..	..	..	..	370 19 4	—
Maintenance and Improvements, Royal Botanic Gardens and							
St. Clair Experiment Stations	..	..	..	..	..	1,272 5 0	—
Care of Trees on Government Lands	..	..	..	..	..	70 17 0	—
Maintenance, Red House Grounds	..	..	..	..	..	69 17 8½	—
Other Charges	..	..	..	..	..	40 14 4	—
BOTANICAL DEPARTMENT, TOBAGO :							
Personal Emoluments, Travelling	..	..	..	..	..	598 16 9	—
Maintenance, Botanic Station and Government House Grounds..					..	319 9 7½	74 2 10½
ST. AUGUSTINE NURSERY :							
Personal Emoluments	..	..	..	..	..	724 10 3	—
Maintenance, &c.	..	..	..	..	..	2,792 14 7	—
Other Charges	..	..	..	..	..	497 6 8½	1,715 19 0
RIVER ESTATE :							
Personal Emoluments	..	..	..	..	..	1,043 6 8	—
General Maintenance, &c.	..	..	..	..	..	3,350 12 3	3,317 9 7
Improvements	..	..	..	..	..	729 9 0½	—
ST. AUGUSTINE EXPERIMENT STATION :							
Personal Emoluments	..	..	..	..	..	640 16 8	—
Maintenance, Cultivation of Crops, &c.	..	..	..	..	..	1,665 1 1½	146 5 9½
GOVERNMENT FARM, TRINIDAD :							
Personal Emoluments	..	..	..	..	..	715 0 0	—
Maintenance	..	..	..	..	..	4,687 5 6½	6,122 14 6
Purchase of Stock (Trinidad and Tobago)	..	..	..	..	..	554 6 11	—
GOVERNMENT FARM, TOBAGO :							
Personal Emoluments	..	..	..	..	..	—	—
Maintenance	..	..	..	..	..	678 10 2½	371 14 10
GOVERNMENT VETERINARY SURGEON :							
Assistant Examiners and Contingencies	..	..	..	..	..	327 4 2½	—
Paralytic rabies	..	..	..	..	..	578 12 1½	—
Bat investigation	..	..	..	..	..	790 17 10	1,816 7 0
QUEEN'S PARK AND PASTURES :							
Personal Emoluments	..	..	..	..	..	341 15 0	—
Maintenance	..	..	..	..	..	661 5 9½	240 12 2
DISTRICT SERVICE :							
Personal Emoluments, Travelling, &c.	..	..	..	..	..	5,196 0 5½	—
PLANT PROTECTION ORDINANCE :							
Destruction of Pests on Crown Lands	..	..	..	..	..	142 19 5½	—
Frog hopper Investigation	..	..	..	..	..	2,126 0 0	—
Control of Plant Diseases and Pests	..	..	..	..	..	5,371 13 11½	—
AGRICULTURAL CREDIT SOCIETIES :							
Personal Emoluments, Travelling, &c.	..	..	..	..	..	84 17 2½	—
TOBAGO ABATTOIR :							
Maintenance, Travelling, &c.	..	..	..	..	..	103 6 7	49 6 6
MARPER FARM :							
Maintenance	..	..	..	..	..	899 2 2	398 19 11½
Total	..	..	..	..	..	£47,826 4 0	£16,738 14 2½

APPENDIX B.

Principal Agricultural Exports, Trinidad and Tobago.

	1933.		1934.	
	Quantity.	Value.	Quantity.	Value.
CACAO :		£		£
Raw Cacao	51,311,274 lb.	555,907	26,803,149 lb.	349,694
SUGAR CANE AND PRODUCTS :				
Vacuum pan, Grey Crystal	92,035 tons	897,966	73,654 tons	643,156
Do. White Crystal	..	..	..	..
Do. Yellow Crystal	16,102 tons	214,193	19,442 tons	269,694
Molasses Crystal	379 tons	3,408	417 tons	3,382
Muscovado Sugar	..	..	..	..
Molasses	3,026,077 gals.	31,634	2,310,381 gals.	24,115
Rum	63,907 gals.	12,853	50,977 gals.	11,488
Bitters	11,850 gals.	21,115	16,916 gals.	29,184
COCONUT AND PRODUCTS :				
Coconuts	7,888,980 No.	21,406	9,850,299 No.	29,128
Copra	19,357,980 lb.	82,945	17,928,775 lb.	57,451
Coconut Oil	45,565 gals.	3,658	31,118 gals.	2,244
COFFEE :				
Raw Coffee	339,196 lb.	7,416	525,115 lb.	10,595
RUBBER :				
Raw Rubber	..	..	68,914 lb.	1,437
LIMES :				
Limes	2,101½ brls.	2,381	1,439 brls.	1,991
Pickled Limes	13 brls.	40	25 brls.	78
Lime Juice	29,084 gals.	1,825	12,589 gals.	829
Lime Oil	1,889 gals.	22,575	2,882 gals.	25,055
Citrate of Lime	52,800 lb.	389	96,693 lb.	641
GRAIN, PULSE, STARCHES, &c. :				
Corn (Maize)	..	..	33,621 lb.	135
Peas and Beans	393,554 lb.	2,515	302,257 lb.	1,899
FRUIT :				
Grapefruit	3,433 boxes	2,586	23,518 boxes	18,634
Oranges	650 boxes	485	..	..
Other Kinds	..	166	..	87
MISCELLANEOUS :				
Plants and Seeds	..	165	..	110
Spices (Nutmegs)	8,808 lb.	160	12,759 lb.	222
Honey	17,725 lb.	210	35,573 lb.	497
Live Stock	79 No.	1,392	48 No.	756
Hides and Skins	9,370 No.	5,708	9,710 No.	5,211
Leather (unmanufactured)	8,521 lb.	384	9,240 lb.	405
		£1,893,482		£1,763,778

APPENDIX C.

ANNUAL RAINFALL 1862 TO 1934, PORT-OF-SPAIN, TRINIDAD.

1862 to 1899 at the Royal Botanic Gardens. January, 1900 onwards at the closely adjacent
St. Clair Experiment Station.

YEAR.	JAN.	FEB.	MAR.	APRIL.	MAY.	JUNE.	JULY.	AUG.	SEPT.	OCT.	NOV.	DEC.	Annual Rainfa ¹⁾ .	
	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Inches.	
1862	..	..	.66	.77	.25	1.41	8.47	10.36	9.57	11.97	6.60	10.06	3.03	63.15
1863	..	1.54	2.71	1.45	.85	1.26	9.12	10.12	10.53	12.11	6.24	4.30	6.57	66.80
1864	..	2.51	.53	.36	.04	8.15	4.96	7.17	12.06	8.04	6.53	5.94	6.61	62.90
1865	..	2.62	3.20	1.07	7.98	3.22	5.64	10.35	14.83	7.32	14.62	4.81	9.62	85.28
1866	..	2.24	3.91	1.44	1.09	1.45	6.59	7.83	12.34	5.87	10.11	8.17	6.82	67.86
1867	..	1.31	6.36	.83	1.32	2.33	5.30	12.20	15.21	10.45	7.87	.67	2.71	66.56
1868	..	2.06	.82	3.20	.64	4.17	7.78	11.35	6.73	5.46	4.66	8.31	1.03	56.21
1869	..	.08	.93	.74	.41	.69	5.52	10.17	8.74	8.86	5.15	6.30	5.87	53.46
1870	..	2.61	.56	1.46	1.51	4.65	8.81	11.91	9.00	10.63	3.98	5.94	8.29	69.35
1871	..	6.62	1.40	2.89	.92	3.97	8.84	11.73	12.97	7.87	4.37	10.73	3.27	75.58
1872	..	1.45	.07	.74	.39	3.14	7.09	5.45	10.82	3.07	4.80	9.89	3.04	49.95
1873	..	1.78	1.08	1.98	.53	..	4.31	5.04	8.37	5.80	10.34	3.48	1.31	44.02
1874	..	3.47	1.96	3.67	5.16	2.51	12.28	12.28	11.20	9.38	6.42	3.66	4.29	76.28
1875	..	3.39	.91	.56	.42	2.61	4.15	12.62	7.22	11.95	10.85	3.74	2.48	60.90
1876	..	3.26	1.03	1.78	1.67	6.65	11.17	12.23	15.18	12.03	7.04	5.95	3.96	81.95
1877	..	2.14	..	7.46	3.38	3.19	8.43	8.35	12.94	6.39	6.68	7.66	5.48	72.10
1878	..	3.44	.70	..	3.22	4.99	5.78	5.42	8.88	11.15	5.89	8.72	3.05	61.24
1879	..	1.52	2.76	4.56	3.03	3.08	14.92	6.86	10.35	6.15	3.54	4.28	4.38	65.43
1880	..	11.72	6.53	.67	2.32	3.90	7.83	6.30	17.39	7.47	5.74	10.51	1.96	82.34
1881	..	.57	.65	.23	1.60	4.66	11.05	7.82	10.90	10.59	3.36	12.06	2.23	65.72
1882	..	1.33	2.38	.73	1.57	3.74	6.33	5.93	8.40	4.93	5.86	10.29	1.50	52.99
1883	..	1.56	.71	.26	3.37	5.89	10.91	13.66	10.26	5.53	3.99	6.06	8.30	70.50
1884	..	3.43	2.50	4.40	1.51	2.91	6.84	5.71	8.70	5.03	5.05	5.14	5.66	56.88
1885	..	1.30	.89	1.49	.43	5.27	3.44	5.87	4.56	6.08	4.08	5.37	4.44	43.22
1886	..	3.32	1.97	3.27	3.83	4.49	9.70	17.48	8.15	6.73	12.59	8.54	6.75	86.82
1887	..	2.69	1.46	1.67	1.08	3.98	7.40	5.51	9.93	5.07	5.84	7.60	11.86	64.09
1888	..	8.37	1.79	2.41	2.28	3.46	11.92	6.89	7.02	5.53	5.06	7.76	2.95	65.44
1889	..	.94	.85	4.16	1.05	6.34	11.66	12.14	11.73	3.76	6.30	7.38	7.48	73.79
1890	..	7.76	.51	2.09	7.62	5.14	9.68	12.89	11.65	3.37	10.98	5.93	5.28	82.90
1891	..	3.17	.92	.03	1.44	2.54	5.54	11.88	4.26	7.44	5.77	6.66	4.09	53.74
1892	..	1.93	2.19	1.85	7.59	11.55	16.26	15.55	9.21	3.57	11.49	5.40	4.69	91.28
1893	..	3.43	1.85	.19	3.61	11.35	10.19	13.28	16.32	11.73	5.47	7.84	7.23	92.49
1894	..	3.22	2.36	3.12	1.22	2.69	3.26	4.53	12.06	5.48	3.93	7.28	3.16	52.31
1895	..	2.52	1.33	2.27	2.52	2.11	5.00	2.57	4.86	5.69	10.89	15.15	7.32	62.23
1896	..	7.08	.88	1.59	2.33	1.62	10.29	6.35	7.66	6.46	6.05	9.81	6.33	66.45
1897	..	1.67	.75	3.96	.26	5.58	11.19	13.88	7.90	9.83	8.87	9.39	4.40	77.68
1898	..	3.05	2.18	2.10	1.17	1.49	6.46	5.87	10.55	7.13	6.15	9.13	3.57	58.85
1899	..	1.95	1.82	1.00	.75	.52	7.63	4.44	8.45	2.18	6.34	8.07	3.61	46.76
1900	..	3.56	.76	2.72	4.10	4.14	12.99	7.95	11.07	5.52	6.53	5.41	2.61	67.36
1901	..	1.95	1.51	1.85	.35	6.45	9.21	8.38	7.53	4.26	4.97	7.93	4.83	59.22
1902	..	2.56	.51	1.18	1.78	2.14	10.05	5.20	11.67	7.22	7.40	2.74	2.89	55.34
1903	..	1.51	.68	1.54	2.17	.95	5.42	9.40	9.45	11.41	2.12	2.59	4.20	51.44
1904	..	3.00	2.56	4.24	2.50	2.76	6.23	8.03	4.72	8.81	5.65	3.61	4.32	56.43
1905	..	2.41	.59	3.74	1.79	4.34	6.01	9.49	11.09	10.43	6.94	10.69	4.16	71.68
1906	..	.43	.50	.73	.46	7.96	10.95	11.42	8.55	6.54	6.80	5.00	5.64	64.98
1907	..	5.22	.44	1.71	.09	4.58	11.01	11.02	5.77	7.76	7.65	10.69	4.10	70.04
1908	..	.75	.45	1.79	.95	5.82	5.22	5.87	7.72	5.45	5.45	2.65	8.68	50.80
1909	..	5.69	2.43	1.15	1.78	3.87	8.31	10.72	6.29	6.95	7.15	3.93	6.31	64.58
1910	..	2.79	4.38	1.75	2.01	2.76	6.34	6.40	13.89	8.27	9.21	8.49	1.90	68.19
1911	..	1.61	1.51	1.86	.74	1.27	7.15	5.20	13.68	4.03	10.22	3.57	3.53	54.37
1912	..	.62	Nil.	.74	.03	2.18	7.54	12.16	5.56	5.87	2.73	6.28	5.64	49.35
1913	..	2.80	.50	1.42	.42	1.79	2.80	2.86	6.48	6.52	3.51	8.61	1.82	39.53
1914	..	.50	.61	1.28	1.01	2.05	7.34	5.05	9.15	7.90	6.14	7.61	5.58	54.12
1915	..	2.10	.66	..	2.63	2.76	7.05	12.76	5.27	4.21	9.28	7.84	1.75	55.31
1916	..	5.29	1.35	1.57	1.91	.94	10.30	8.04	11.57	10.78	6.68	9.32	1.98	69.73
1917	..	1.17	3.06	1.38	.50	4.24	6.30	10.13	9.96	7.24	5.43	6.61	8.22	64.24
1918	..	3.15	1.18	1.48	1.27	2.94	5.87	14.42	8.56	8.93	5.51	7.56	3.85	64.72
1919	..	.62	..	1.78	1.67	3.50	6.78	5.17	6.82	7.96	7.79	8.42	6.67	57.18
1920	..	1.39	1.66	.94	.28	.56	4.13	4.93	6.70	10.98	5.74	6.00	1.60	44.94
1921	..	2.43	1.60	5.03	4.09	1.43	9.91	10.06	10.30	10.17	6.53	7.71	6.25	75.51
1922	..	4.01	1.13	1.41	2.39	2.18	6.10	5.06	8.35	6.49	2.92	11.17	7.10	58.31
1923	..	1.91	1.66	.96	2.97	1.46	3.48	10.76	9.37	6.23	4.41	7.38	7.32	57.91
1924	..	1.54	.90	.14	1.11	.73	4.95	7.53	7.27	4.59	7.81	8.56	2.15	47.28
1925	..	1.77	1.06	2.67	.10	1.21	4.20	7.58	8.87	6.37	5.85	5.36	4.36	49.40
1926	..	.69	.39	.54	.23	2.12	5.26	5.25	10.85	11.20	14.78	9.71	7.56	68.58
1927	..	4.71	4.44	3.62	5.04	7.15	6.95	9.40	11.67	9.11	6.13	5.64	7.21	81.07
1928	..	4.22	.69	2.31	2.02	.67	5.75	8.07	8.66	7.36	9.13	8.42	5.94	63.24
1929	..	.84	.84	1.78	.81	7.33	6.43	5.10	8.90	5.21	3.40	9.30	1.51	51.45
1930	..	2.70	.08	.31	2.38	1.85	6.35	7.12	4.94	5.82	6.27	2.59	4.87	45.28
1931	..	1.68	1.11	.07	.29	1.12	6.94	10.96	8.89	4.85	6.59	7.94	5.77	56.21
1932	..	5.61	1.72	4.33	3.99	9.25	10.53	5.80	16.04	3.85	4.60	10.23	8.01	83.96
1933	..	3.87	1.25	1.91	1.36	2.85	10.19	9.93	16.07	11.52	7.41	5.38	6.29	78.03
1934	..	2.51	.90	.74	.17	.82	3.05	9.43	7.24	6.55	8.50	10.08	5.30	55.35
Grand Total .	200.66	107.22	133.12	135.75	254.87	558.93	636.64	705.82	532.33	486.73	523.03	354.54	4,629.70	
Av. for 73 years	2.75	1.47	1.82	1.86	3.49	7.66	8.72	9.67	7.29	6.67	7.16	4.86	63.40	

